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THE SCIENTIFIC ENQUIRER:

A MONTHLY MEDIUM FOR THE SUPPLY OF INFORMATION ON ALL

Scientific Subjects.

EDITED BY

ALFRED ALLEN,

(EDITOR OF "THE JOURNAL OF MICROSCOPY AND NATURAL SCIENCE" AND HON. SEC. OF THE POSTAL MICROSCOPICAL SOCIETY.)

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To Our Readers.

WE have endeavoured, during the past year, to fulfil our promise further to improve the "SCIENTIFIC ENQUIRER," but the amount of labour entailed is more than we feel justified in imposing upon ourselves and friends.

With this number we bring those labours to a close, and in bidding farewell to the "SCIENTIFIC ENQUIRER," express the hope of addressing many of our readers through "THE JOURNAL OF MICROSCOPY," in which we hope to introduce some of the features which have distinguished the "ENQUIRER."

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The Scientific Enquirer.

JANUARY, 1888.

TO OUR READERS.

THE announcement in our last number of my intention to discontinue the *Scientific Enquirer* has been received with so much regret, and produced so many offers of literary aid and active sympathy, that I have felt constrained to reconsider my decision, and, accepting the kind offers received, to resume the Editorial supervision of the labours of the numerous friends and correspondents of the *Enquirer*.

Personally, I thank our readers for the interest expressed in the welfare of the *Enquirer*, and in accepting the numerous offers of literary assistance reserve to myself the right to insert or decline any communication in the interest of Readers as well as of the *Enquirer*, at the same time assuring my correspondents of my appreciation of their kindness, and soliciting their support, not only in the Editorial, but in that scarcely less important, although more prosaic, the Publishing or Financial department.

The Publishers will have the greatest pleasure in receiving the names of Subscribers, and executing orders for back numbers or complete volumes, and it must not be forgotten, that as Stationers and Printers require metallic returns for their contributions, the Editor and Proprietors are desirous of increasing the number of regular Subscribers.

The Annual Subscription—prepaid, 4/6 per annum—should be sent to the Publishers, Messrs. Baillière, Tindall, and Cox, 20 King William Street, Strand, London, W.C.; Editorial communications to me, at 1 Cambridge Place, Bath.

Very faithfully yours,

ALFRED ALLEN.

The Sudden Appearance and Gradual Extinction of Certain Species of Plants in Limited Areas.

By G. A. Grierson.*

IN Wallace's "Island Life" (p. 481) the following sentence occurs :—"It is a well-known fact that fresh surfaces of soil or rock, such as are presented by railway cuttings and embankments, often produce plants strange to the locality, which survive for a few years, and then disappear as the normal vegetation gains strength and permanence." Mr. Wallace makes use of the fact to show how the flora of one district may spread into another at a very great distance, and yet leave no trace of its progress. He mentions it as probable that it is in this way the Scandinavian flora has reached the southern hemisphere. Mr. Wallace attempts no explanation of the fact, but contents himself with citing numerous instances proving conclusively that it is so.

We may, therefore, take it as an indisputable fact that plants do spring up in this way. In order to account for this apparently erratic distribution, it will be necessary to give correct answers to two questions: (1) Whence come the seeds which give rise to these plants? (2) Why do the plants so originated gradually die out in the majority of cases? In answer to the first question, there are two possibilities. Either the seeds pre-exist in the soil, but at too great a depth to germinate, and on the soil being turned over, as in the making of a ditch or railway-cutting, this obstacle is removed, and we have a repetition of the flora of an earlier period; or the seeds are carried by the wind and germinate freely in the freshly-exposed earth, while those which fall on the surrounding over-crowded and comparatively exhausted soil, meet with an early death. The second question has, I think, only one possible answer: the soil becomes exhausted of the constituents most suitable for the growth of that particular species; the species therefore becomes unfit to contend successfully with its better adapted neighbours, and, consequently, goes to the wall.

In the absence of conclusive experiments, it is impossible to answer the first question with absolute certainty, and I would take the liberty of suggesting that some of our country pharmacists,

* From *The Pharmaceutical Journal.*

who have the opportunity and the necessary leisure, should take the subject up and remove it from the regions of empiricism to those of certainty. The necessary experiments could easily be conducted on a well-exposed piece of land of moderate size, by turning over the soil in contiguous areas at different seasons, and by the judicious use of gauze and glass work.

Confining our attention to the evidence before us, there is, at least, one test that must appear as crucial in settling the relative merits of the two theories. If the seeds are wind-borne, no soil which is turned over in spring will produce its crop of new plants until the following year, that is, until the plants of the same species in the neighbourhood have seeded. While in Lincolnshire, during the present year, my attention was called to a case in which a ditch had been dug in the early spring, and in the same year a crop of thistles sprang up all along the newly-turned soil. Now, it is quite evident that any pre-existing thistles in the neighbourhood could not have been in seed at that time; indeed, they would scarcely have commenced to send up their stems. As a matter of fact, however, there were no thistles for a considerable distance round. In this case, then, the thistle seeds must have been buried in the soil.

Mr. A. Bennett, of Croydon, in a communication to Mr. Wallace, states that the first year after the railway from Yarmouth to Caistor, in Norfolk, was made, the banks produced abundance of *Œnothera odorata* and *Delphinium ajacis* (the latter only known thirty miles off). The new introductions, however, gradually disappeared, giving way to the native plants. A similar phenomenon was noted by the same observer between Chesterton and Newmarket, in Cambridgeshire, where *Stellaria media*, and other annuals appeared in large patches, and in about three years disappeared. Neither *Delphinium* nor *Stellaria* has seeds which are likely to be carried by the wind. Mr. T. Kirk states that in Auckland the fiddle dock (*Rumex pulcher*) occurs in great abundance on the formation of new streets, etc., but soon becomes comparatively rare. He thinks it probable that it was one of the earliest plants naturalised there, but that it partially died out, its buried seeds retaining their vitality.

In a letter to the *Pharmaceutical Journal* of April 25, 1885, I called attention to the sudden appearance of an abundance of *Hyoscyamus niger* and *Sinapis alba* on the earth turned over in making a new road on the island of Inchkeith, in the Firth of Forth, and to the fact that they are now gradually dying out, the former having almost entirely disappeared. On making further inquiry into this case, I find it gives greater probability to the buried seed theory than I at first supposed. On my first visit to the island the plants were in flower and as the henbane only

flowers in its second year, I find from a comparison of dates that the first year's plants must have made their appearance in the year in which the road was made, thus rendering it improbable that the seeds were derived from the plants already in existence, and of which there were only one or two on the island. In a reply to that letter, Mr. J. C. Shenstone mentions a case from his own experience which also tends to confirm the buried-seed theory.

There need be little difficulty in accounting for the presence of dormant seeds in the soil. Let it be granted that at one time some given species were common in a district; through the exhaustion of the soil, however, they gradually died out, that is, a smaller number of plants appeared. This could only have arisen from the fact that a smaller number of seeds germinated; there would, therefore, be left a number of seeds capable of germinating, and only waiting for suitable conditions to enable them to do so. Most of the seeds which did not germinate, and remained at the surface, would undergo the ordinary process of decay. Many, however, would find their way to greater depths, some of them being washed down by water, others, and I think the greater number, would fall into the numerous cracks which are found on most lands after continued dry weather, a not uncommon condition in autumn. The mere fact that this cracking process takes place most abundantly in the fruiting season renders this hypothesis, at least, highly probable. On the return of wet weather the cracks would close up, and the seeds would be preserved until the soil was turned over. Their germination would be prevented by the exclusion of air and light, and for the same reason they would not undergo decay. One difficulty is, that under ordinary conditions seeds only retain their power of germinating for limited periods, but under the conditions which hold here, I think it not by any means improbable that they will retain their vitality for much longer periods.

Even if it were admitted that most cases of the phenomenal appearance of plants on newly turned soil were to be traced to dormant seeds derived from an earlier flora, it does not follow that in certain cases there are not other causes at work. For instance, seeds may be brought at times by animals and by the wind, and would naturally germinate more vigorously on fresh than on crowded soil, but I think such cases are exceptional. One very remarkable case of the agency of the latter is, however, found in a species of *Senecio*, known in Tasmania as "fire-weed." This plant makes its appearance on patches of land that have been cleared by fire, and on those patches only. Mr. Wallace mentions a case in which a burnt patch, thirty-five miles into the virgin forest, and consequently that distance from the nearest *Senecio*, immediately produced its crop of fire-weed.

Our Rocks and their Fossils.

We have adopted an easy and slovenly way of dividing all rocks into primary, secondary, and tertiary, which veils from us the real chronological relations of evolving life in the different periods. The lias is ranked by geologists among the earliest secondary formations; but if we were to distribute all the sedimentary rocks into ten great epochs, each representing about equal duration in time, the lias would really fall in the tenth and latest of all; so very misleading to the ordinary mind is our accepted geological nomenclature. Nay, even commonplace geologists themselves often overlook the real implications of many facts and figures which they have learned to quote glibly enough in a certain off-hand way. Let me just briefly reconstruct the chief features of this scarcely-recognised world's chronology as I sit on this piece of fallen chalk at the foot of the mouldering cliff, where the stream from the meadow above brought down the newest landslip during the hard frosts of last December. First of all, there is the vast lapse of time represented by the Laurentian rocks of Canada. These Laurentian rocks, the oldest in the world, are at least 30,000 feet in thickness, and it must be allowed that it takes a reasonable number of years to accumulate such a mass of solid limestone or clay as that at the bottom of even the widest primæval ocean. In these rocks there are no fossils, except a single very doubtful member of the very lowest animal type. But there are indirect traces of life in the shape of limestone probably derived from shells, and of black lead probably derived from plants. All these early deposits have been terribly twisted and contorted by subsequent convulsions of the earth, and most of them have been melted down by volcanic action, so that we can tell very little about their original state. Thus the history of life opens for us, like most other histories, with a period of uncertainty. Its origin is lost in the distant vistas of time. Still, we know that there *was* such an early period; and from the thickness of the rocks which represent it we may conjecture that it spread over three out of the ten great æons into which I have roughly divided geological time. Next comes the period known as the Cambrian, and to it we may similarly assign about two and a half æons on like grounds. The Cambrian epoch begins with a fair sprinkling of the lower animals and plants, presumably developed during the preceding age; but it shows no remains of fish or any other vertebrates. To the Silurian, Devonian, and Carboniferous periods we may roughly allow an æon and a fraction each; while to the whole group of secondary and tertiary strata, comprising almost all the best known English formations—red

marl, lias, oolite, greensand, chalk, eocene, miocene, pliocene, and drift—we can only give a single æon to be divided between them. Such facts will sufficiently suggest how comparatively modern are all these rocks when viewed by the light of an absolute chronology. Now, the first fishes do not occur till the Silurian—that is to say, in or about the seventh æon after the beginning of geological time. The first mammals are found in the trias at the beginning of the tenth æon. And the first-known bird only makes its appearance in the oolite, about half-way through that latest period. This will show that there was plenty of time for their development in the earlier ages. True, we must reckon the interval between ourselves and the date of the blue mud at many millions of years; but then we must reckon the interval between the lias and the earliest Cambrian strata at some six times as much, and between the lias and the lowest Laurentian beds at nearly ten times as much. Just the same sort of lessening perspective exists in geology as in ordinary history. Most people look upon the age before the Norman Conquest as a mere brief episode of the English annals; yet six whole centuries elapsed between the landing of the real or mythical Hengst at Ebbsfleet and the landing of William the Conqueror at Hastings; while under eight centuries elapsed between the time of William the Conqueror and the accession of Queen Victoria. But, just as most English histories give far more space to the three centuries since Elizabeth than to the eleven centuries which preceded them, so most books on geology give far more space to the single æon (embracing the secondary and tertiary periods) which comes nearest our own time, than to the nine æons which spread from the Laurentian to the Carboniferous epoch. In the earliest period, records either geological or historical are wholly wanting; in the later periods they become both more numerous and more varied in proportion as they approach nearer and nearer to our own time.

So, too, in the days when Mr. Darwin first took away the breath of scientific Europe by his startling theories, it used confidently to be said that geology had shown us no intermediate form between species and species. Even at the time when this assertion was originally made it was quite untenable. All early geological forms, of whatever race, belong to what we foolishly call "generalised" types. For example, the earliest ancestral horse is partly a horse and partly a tapir: we may regard him as a *tertium quid*, a middle term, from which the horse has varied in one direction and the tapir in another, each of them exaggerating certain special peculiarities of the common ancestor and losing others, in accordance with the circumstances in which they have been placed. Science is now perpetually discovering intermediate forms, many

of which compose an unbroken series between the unspecialised ancestral type and the familiar modern creatures. Thus, in this very case of the horse, Professor Marsh has discovered a long line of fossil animals which lead in direct descent from the extremely un-horse-like eocene type to the developed Arab of our own times. Similarly with birds, Professor Huxley has shown that there is hardly any gap between the very bird-like lizards of the lias and the very lizard-like birds of the oolite.

Short Papers and Notes.

A few Good Objects for the Microscope.

THIS short paper does not in any way pretend to give a complete list, but merely a few objects of general interest, say, for a social evening. A transverse section of Laburnum wood, when mounted in balsam without any previous soaking in turpentine, shows the different shades of colour, from red and yellow to the palest amber, intermixed with brown, is very pleasing; sections of Deal, Rhubarb, scales of the Sulphur and Cabbage Butterflies, a Goldfinch and Lark's Feathers, Elder-pith, Palates of Molluscs, the tongue of which forms the floor of the mouth, and the front part, which is the only part in use, is frequently curved and bent quite over, and its teeth are often broken and blunted; the posterior portion descends obliquely behind the mouth, and its edges are united to form a tube, and enclosed in a membranous sheath, which opens gradually as the part is brought forward to replace the worn portion. The most simple way to prepare these as microscopic objects, is to boil the head of the mollusc in a solution of potash in a test-tube, by which all the parts, with the exception of the tongue and jaw, are dissolved; care must be taken to thoroughly wash the tongue before mounting. The most instructive method is undoubtedly that of dissection. The head should be pinned down in a gutta-percha trough, or on a piece of leaded cork, containing water enough to cover the part. The floor of the mouth may be laid open by passing the lower point of a pair of scissors into the mouth, and cutting upwards; now pin back the severed portions, and by aid of a lancet or needle, work out the lingual apparatus. The ribbon should be cleaned by washing with a camel's-hair brush, or by soaking in potash-water; if the latter, wash the tongue *thoroughly* before mounting. The preparation may be mounted in glycerine, or, if intended as an object for the polariscope, it should be mounted in Canada balsam.

V. A. LATHAM.

The Jelly-Fish.

One of the most notable cases of the curious development amongst the jelly-fishes is illustrated by the history of one of the commonest members of the race—the *Aurelia aurita*, whose title to be called the "common jelly-fish" can hardly be disputed. From the egg of this organism is first developed a little oval, free-swimming speck named the *planula*. Attaching itself to some fixed object, the planula assumes a pear-shaped form, and, as a depression at its free end deepens to form a mouth, little tentacles bud out around the opening. In such a guise—exactly resembling the hydra of our fresh-water pools, or the primitive bud of a zoophyte—does the progeny of the Aurelian jelly-fish appear; and when the tentacles have become numerous it receives the name of *Hydra tuba*—a term applied, under the belief that it was a distinct form of animal life, by Sir J. G. Dalyell, the once-famous authority on zoophyte life and structure. In length the *Hydra tuba* organism measures about half-an-inch, and, curiously enough, it has been known to continue in this stage of development for years. It, moreover, possesses a power of producing other *Hydra tubæ* by a process of budding, and thus comes to imitate perfectly the conditions of zoophyte existence. Its further history begins when the body elongates, and when it becomes marked across by grooves or indentations, which gradually deepen, whilst their edges become notched. In this stage Sars named the organism *Scyphistoma*, believing it to be a new and mature animal. As the *Hydra tuba* becomes further divided cross-wise, it assumes the appearance aptly described as a pile of saucers with notched edges placed one within the other, their hollows being turned upwards. Now it is known as the *Strobila*. Sooner or later this pile of saucer-like bodies—each called an *Ephyra*—falls to pieces; the saucers each swim freely in the water; they assume a more concave form, and appear before the observer as veritable jelly-fishes, or *Aureliæ*, which pulsate through the sea, and which exhibit all the characteristics of their species and race. Not the least surprising fact in connection with this curious life-history is that which informs us of the extreme disparity between the size of the *Hydra tuba* and of the beings to which it may thus give origin. A *Hydra tuba* measuring about half-an-inch long breaks up into saucer-like *Ephyræ*, or jelly-fishes, each of which latter, when fully developed, may measure seven feet in diameter and may possess tentacles fifty feet long. Huge oceanic jelly-fishes, occurring in tropical seas, and measuring from six to eight feet across, thus spring from a fixed organism whose diminutive size would seem to preclude the possibility of its containing even potentially the energies requisite for the development of an ordinary-sized jelly-fish. Such facts are not unparalleled in higher life-histories. The germ of the sperm whale is a mere microscopic

speck in its earlier phases; and the red kangaroo, which in its full growth attains a height of seven feet and a half, measures at birth about an inch in length.

The Filmy Ferns.

Our native filmy ferns are the tiniest and most fragile-looking of the British species. They indeed occupy the sort of borderland which exists between ferns and mosses. The common name of these ferns very accurately represents their peculiar character, which is filmy and pellucid. The generic botanical name, *Hymenophyllum*, is compounded of two Greek words—*hymen*, "a membrane," and *phyllon*, "a leaf," and refers to the membranous nature of the leafy expansion of the frond. If the leafy texture of the latter be examined with a magnifying glass, it will be found to be beautifully reticulated, or its thin and almost transparent substance to be woven of vegetable fibres like network. The specific name of *Hymenophyllum Tunbridgense* refers to the fact of its having been first noticed as a British fern in the neighbourhood of Tunbridge Wells. It is mostly found growing in the damp surfaces of shady rocks, situated either along some watercourse or in damp woods. But not unfrequently it has been found clothing the trunks of trees in or near streams, or in very damp and sheltered situations, and occasionally even growing amidst moss on the ground. In such situations it is commonly found growing in company with mosses of various kinds, its hairlike rhizomas and rootlets being intermixed with the mossy roots.

We have found both the filmy ferns growing in great abundance upon the sides of a hill bordering a moorland stream and covered by great masses of rock, amongst which there were trees and much other vegetation of a dwarfed or herbaceous kind. The situation was an extremely moist one, great mist occasionally rising from the river and enveloping the hillside. Clambering from rocky mass to rocky mass, we discovered that in numerous dark crevices formed by the overlapping edges of several rocks, the whole internal surface of stone was densely covered by a carpeting of *Hymenophyllum*, which was especially pleasant and luxuriant where trickling moisture oozed down from the higher hillside along the external surface of the rock. So dark were some of the rocky holes that one could not look into their depths, and sometimes, in order to reach the spreading masses of *Hymenophyllum*, it was necessary to lie down along the top of the rock, and stretch out the hand at arm's length. In many places, however, so moist was the entire atmosphere of the district, that the open tops and sides of great stony boulders were densely carpeted with filmy ferns, the thick masses of their rhizomas and rootlets having no depth of earth, but merely clinging to the damp surface of the boulders.—*Fern World.*

The Vallisneria Spiralis.

In studying the rotation in the *Vallisneria Spiralis*, I have often noticed that a piece of leaf, about an inch long, has shown the circulation ten days or so after it has been cut off from the parent plant. That life should be kept up so long afterwards seems rather extraordinary, but of course the grains of chlorophyll travel more slowly in the stream of protoplasm, round the cells, as time goes on. This is a curious and interesting subject, and contrary to all laws in the animal world, as a limb dismembered directly loses all its circulation. I suppose the leaf, though severed from the plant, still, through the stomata, has power to obtain nourishment from the water. M. A. Henty.

Incombustible Materials.

The composition by which the French lace is rendered incombustible, is equally adapted to render wool and flannel uninflammable. It is a mixture of eighty parts sulphate of ammonia, twenty-five parts carbonate of ammonia, thirty parts boracic acid, seventeen parts pure borax, twenty parts starch, and one thousand parts distilled or pure water. These ingredients are most thoroughly combined ; the materials are dipped in the solution when hot, so as to be completely impregnated, after which they are dried and ironed as ordinary starch fabrics.

To Prepare the Head of a Flea.

Having first caught it, immerse for two or three weeks in spirit of wine, and then having covered it with a drop of thick gum on a slip of glass, to prevent flying under the knife, sever the head from the body and legs ; press this severely between two slips while on the stage of the microscope, and when the parts are seen to be fully developed, dip in spirit of turpentine, mount at once in balsam under strong pressure, for the integument is thick and as hard almost as tortoise-shell. A more transparent preparation might be made by using a caustic solution, but this will mostly be at the sacrifice of some delicate parts.

V. A. Latham.

A Classical Remedy for Hiccough.

Dr. A. Gibson (*Edinburgh Med. Journ.*) recommends tickling the nose in a case of hiccough. It is not necessary always to cause sneezing to interrupt the spasm of the diaphragm, but if sneezing should occur the hiccough stops at once. This is in accordance with the aphorism of Hippocrates :—Ὑπὸ λυγμοῦ ἐχομένῳ πταρμοὶ ἐπιγενόμενοι, λύουσι τὸν λυγμον, which Mr Gibson renders—"Sneezing, occurring after hiccough, removes the hiccough."

This mode of treatment is not to be sneezed at, although it may probably make the patient sneeze.

Diving Perils.

When the P. and O. Company's ship "Ava" was wrecked on the coast of Ceylon, a very expert diver, Pound by name, was employed to raise £220,000 in bullion, which had gone down with the wreck. Pound, attired in the ordinary gutta-perch diving suit, had made his way into the saloon of the sunken vessel, when, to his horror, he saw a huge ground-shark come sailing in at the door. The diver instantly, and with marvellous presence of mind, lay motionless. For ten minutes the shark moved round and round the saloon. Pound expected, from the manner in which the deadly monster fixed his cold, green eyes upon him, that he would presently turn over (a shark always turns on its back when attacking) and make a rush at him. But after it had spent over ten minutes in the saloon, it made its way out. Had the fish made the slightest puncture in the gutta-percha suit, the diver would have been drowned. Pound ever afterwards carried with him a long dagger. Altogether he spent 850 hours under water while engaged in raising the bullion from the "Ava."

The Region of Ice.

According to intelligence received at Hamburg, advices from the waters of Spitzbergen now confirm the former news from Iceland and from the mouth of the Petchora, on the Siberian coast, to the effect that the ice in the Arctic Sea has this year extended unusually far to southward. Spitzbergen, the sealers report, was found to be surrounded with an ice-belt five to eight miles broad, and there was firm pack ice from Hope Island to Forland, about fifty-six miles. The great bays on the Storfjord Hornsund, Bellsund, and Isfjord were quite inaccessible, and the sealers, after waiting all the spring and most of the summer, returned at the end of August, as there was no prospect of the Polar ice dividing.

An Electric Sword.

A gentleman of Shanghai has, after considerable experimenting, invented a new and deadly weapon. This is an electric sword, which, when the point touches the party attacked, sends a powerful shock through him, and, if not immediately killing, will at least put him *hors-de-combat*. The sword is an ordinary military sabre, but along its whole length is let in a fine platinum wire, which ends at the foil of the weapon. A small but very powerful storage battery is carried strapped about the waist, much the same

as a cartridge-box. Insulated wires connect this battery with the sword, and by pressing a button the holder can complete the circuit at pleasure.

Raphides in Plants.

At a recent meeting of the Jena Naturalists' Society, Herr Stahl read a paper on the significance of those excreta of plants known as Raphides—*i.e.*, Crystalline needles often met with in the cells in large quantity. From experiments, he inferred that they were a protection to plants against being eaten by animals. Many animals avoid plants with raphides, or eat them reluctantly; and some animals—*e.g.*, small species—in eating plants that have raphides, select those parts that are without the crystals. Many plants held for poisonous—*e.g.*, *Arum maculatum*—owe their burning taste simply to the very numerous raphides, which, forced out of their cells, enter the tongue and palate. The juices obtained by filtration have quite a mild taste.

White Shrew Mouse.

Mr. G. Abbey, writing to the *Journal of Horticulture*, says:—"The Shrew Mouse is a well-known pretty little animal; the formation of its hair as seen under a powerful microscope, is very beautiful. In turning over a manure heap in the park, an albino, or white variety, of this interesting vole was found (Dec. 23, 1887.) It is one of the prettiest creatures I have ever seen, very lively and very clear in colour, having the yellow tinge next the skin as present in most white-haired animals, and in white-feathered birds, otherwise it is of snowy whiteness without speck. It was found next to the soil beneath the manure, which is rather dry and littery, no doubt in quest of food, grubs, etc. White moles, I know, are not uncommon, but this is the first time I have seen or heard of a White Shrew Mouse. I thought it might interest some of your readers if it be worth recording."

Remarkable Crystals.

Some remarkable Crystals were found a short time ago in a gravel bed, near Mokeumne Hill, California. They are of such hardness that the hardest file does not make the least impression on them, and they will cut glass like a diamond. All the specimens are hexagonal cubes, terminating in pyramidal points, the sides being as smooth and regular as the finest cut glass, and of such clearness that objects can be plainly discerned through pieces of a foot in thickness. They are of immense size, the largest having thirteen points starting from a single base, three feet in length, two-and-a-half feet in thickness, and weighing 500 pounds; the next in size is two feet long, eighteen inches in thickness, and weighs about 160 pounds; the others, about two dozen in number, range

from one foot to one-and-a-half feet in thickness, and weigh from 50 to 75 pounds.

Mounting Tongues of Flies.

If the flies are placed in a small, wide-mouthed bottle, containing a few drops of methylated chloroform, the tongues will be found well protruded; if not used at once, place in glycerine.

V. A. L.

To Transfer Pictures from Paper to Wood for Engraving.

Soak the print in a saturated solution of alcohol and white caustic potash to soften the ink, then transfer to the block under roller pressure.

Cairns of Oyster-Shells.

Many British cists and cairns have disclosed relics in the form of shell-necklaces and bracelets made of the oyster, limpet, and cockle-shells, the contents of which supplied an important source of food. For not only in the ancient kitchen middens of Northern Europe, but mingling with more ancient cave deposits, as in Kent's Cavern, lay heaps of the shells of such edible molluscs, the refuse of the repasts of the old cave-men, which show one resource on which they depended for subsistence. America, too, had its ancient shell and refuse heaps, as at Cannon's Point, St. Simon's Island, Georgia, where vast mounds of oyster and mussel shells, intermingled here and there with a *Modiola* or *Helix*, and with flint arrow-heads, stone axes, and fragments of pottery, cover an area of not less than ten acres. They also abound upon all the sea islands of the Southern States, and in many cases constitute regular sepulchral mounds or shell cairns. One of these singular cairns on Halling's Islands, in the Savannah River, more than two hundred miles from its mouth, is an elliptical mound, measuring nearly three hundred feet in length, and enclosing human skeletons, etc. On the island, and along the coasts of Georgia and Florida, the inexhaustible supplies of oysters, conches, and clams furnish abundant food. Around all Indian villages these shells may be observed accumulated in vast heaps; and even now at places they show the circular hollow where the native hut once stood.—*Cassell's Natural History.*

Baby Elephants.

How the young elephants in the large herds escape from being crushed is something of a mystery, as they are almost continually in motion, but when a herd is alarmed, the young almost immediately disappear. A close observer would see that each baby was trotting along directly beneath its mother, sometimes between her fore-legs.

On the march when a little elephant is born in a herd, they stop a day or two to allow it time to exercise its little limbs and gain strength, and then they press on, the mothers and babies in front, the old tuskers following in the rear, but ready to rush forward at the first alarm. When rocky or hilly places are reached, the little ones are helped up by the mothers, who push them from behind and in various ways ; but when a river has to be forded or swam, a comical sight ensues.

The stream may be very rapid and rough, as the Indian rivers often are after a rain, and at such a place the babies would hardly be able to keep up with the rest, so the mother and father help them. At first, all plunge boldly in, both young and old, and when the old elephants reach deep water, where they have to swim, the young scramble upon their backs and sit astride, sometimes two being seen in this position. But the very young elephants often require a little more care and attention, so they are held either upon the tusks of the father, or grasped in the trunk of the mother, and held over or just at the surface of the water. Such a sight is a curious one, to say the least : the great elephants almost hidden beneath the water, here and there a young one seemingly walking on the water, resting upon a submerged back or held aloft while the dark waters roar below.—*St. Nicholas.*

Photographic Notes.

A good Developing Dish.—Several years ago, when dry-plate work was in its embryonic state, I called on Mr. Eastman, who took me into his dark-room to see a plate developed. He was using for a developing pan one made out of sheet copper lined with *tin*. It seemed novel, and I asked him if it had no injurious effects upon the developer, and he replied that he thought not. I had one made as soon as I reached home, and have used the same pan ever since, and though the tin wore through it works just as well. Have had several made since, of different sizes up to 11 by 14, and find them complete and cheap.

Simply sheet-copper tinned on one side. Any tinker can make them, just as the ordinary square tins are made for kitchen use—*i.e.*, with the corners *folded over*, without solder (perhaps a little less flaring at the sides, and as deep as one likes). The bright bottom is an advantage in aiding judgment about intensity of negative. J. S. SUNDERLIN, *in the Philadelphia Photographer.*

Photographing Micro-objects.—Mr. Jennings has published a very interesting paper on the making of photographs of Micro-objects for lantern use. He asserts that the use of the eye-piece

of the microscope does not affect in any way the beauty of the image, and it renders the work of the operator much more easy. Operating without the eye-piece, it is necessary to have a camera which can be extended five or six feet, while with the eye-piece it is possible to use a camera of from ten to twelve inches. For lighting he makes use of a paraffin lamp with the largest possible wick, placed about six inches from the table of the microscope. Between the lamp and the object is placed a condensing lens, so as to concentrate the light upon the object to be reproduced. The body of the microscope being horizontal, the little camera is brought near, the eye-piece introduced into the hole for the lens of the camera, and this portion covered with black velvet, so as to exclude all accidental light.

DR. PHIPSON, in the *Philadelphia Photographer.*

Fixing and Toning Bath.—In a recent number of the *Wochenblatt,* Dr. Stolze has published the following formula for a bath, which fixes and tones prints at the same time :—

Hyposulphate of Soda	35 parts.
Chloride of Sodium	9 „
Alum	4 „
Sulphocyanide of Ammonia	2 „
Water	150 to 200 „

Developing Bath.

No. 1.

Pyrogallic Acid	14 parts.
Sulphite of Soda	100 „
Dis. Water	500 „

No. 2.

Carbonate of Soda	50 parts.
Dis. Water	1000 „

Mix one vol. of No. 1 with two Vols. of No. 2.

L'Amateur Photographe.

Combustible Photogenic Powder.—M. Johannes Gædicke, chemist, of Berlin, and M. Adolf Miethe, of Potsdam, have taken out a patent for an improved process for a magnesium light suitable for Photographic work. The composition which they recommend is as follows :—

Chlorate of Potash	12 parts.
Magnesium in Powder	6 „
Prussiate of Potash	1 „
Or	
Chlorate of Potash	24 „
Magnesium in Powder	12 „
Amorphous Phosphorus	1 „

Practical Hints.

To Fasten Cloth to Wooden Surfaces.—The following is a German process for fastening cloth to the top of tables, desks, etc. :—Make a mixture of 2¼ lbs. of wheat-flour, two tablespoonfuls of powdered resin, and two tablespoonfuls of powdered alum ; rub the mixture in a suitable vessel with water to a uniform smooth paste. Transfer this to a small kettle over the fire, and stir until the paste is perfectly homogeneous (without lump). As soon as the paste has become so stiff that the stirrer remains upright in it, transfer it to another vessel and cover it up, so that no skin may form on its surface. This paste is applied in a very thin layer to the surface of the table ; the cloth, etc., is then laid and pressed upon it and smoothed with a roller. The ends are cut after drying. If leather is to be fastened on, it must be first wetted. The paste is then applied, and the leather rubbed smooth with a cloth.

To Remove Ink from Carpets.—Take up as much as possible with a spoon, pour cold sweet milk upon the spot, and take up with a spoon until the milk is only slightly tinged with ink, then wash with cold water and wipe dry. The writer has in this way removed nearly half-a-pint of ink from a delicate cream-coloured carpet without leaving a stain.

Cement for Aquaria.—One part by measure—say, a gill—of litharge, one gill of plaster of Paris, one gill of dry white sand, one-third of a gill of finely-powdered resin. Sift and keep corked tightly till required for use, when it is to be made into a putty by mixing in boiled oil (linseed), with a little patent driers added. Never use it after it has been mixed (that is, with the oil) over 15 hours. This cement can be used for marine as well as fresh-water aquaria, as it resists the action of salt water. The tank can be used immediately, but it is best to give it three or four hours to dry

Cement to Mend China.—Take a very thin solution of gum arabic, and stir into it plaster of Paris until the mixture is of a proper consistency. Apply it with a brush to the fractured edges of the china ware and stick them together. In a few days, it will be impossible to break the article in the same place. The whiteness of the cement renders it doubly valuable.

Acid-Proof Cement.—How to make a paste or cementing material, that is proof against acid fumes—like those given off in the preparation of nitrate of silver, for instance—is well worth knowing. Finely-powdered glass, mixed with soluble silicate of soda, will give a material of this description.

Washing Fluid.—Take five quarts of water, half-pound of lime, and one pound of sal-soda, and let it come to a boiling point; then settle, pour off, and bottle. Use one and a half cups of this to a washing of five persons. Soak the clothes in cold water over-night. After putting the fluid in a boiler of cold water, let it come to a boiling point; put in the clothes and boil half-an-hour. If any rubbing is required, it will be very easy. Then rinse them in two waters. The above will not injure the clothes.

To Destroy Flies.—Half-a-teaspoonful of black pepper, one teaspoonful of brown sugar, and one tablespoonful of cream; mix them well together, and place on a plate in a room where the flies are troublesome, and they will soon disappear.

To Remove Ink-Stains from Books.—First wash the paper with warm water, using a camel's-hair pencil for the purpose. By this means the surface-ink is got rid of. The paper must next be wetted with a solution of oxalate of potash, or, better still, oxalic acid, in the proportion of one ounce to half-a-pint of water. The ink-stains will immediately disappear. Finally, again wash the stained paper with clean water, and dry it with white blotting-paper.

Economical Gilding.—To gild works of art in bronze, gas-fittings, etc., the following mixture is recommended:—2½ pounds of cyanide of potassium, 5 ounces of carbonate of potassa, and 2 ounces of cyanate of potassa; the whole to be diluted in 5 pints of water, containing in solution ¼-ounce of chloride of gold. The mixture must be used at boiling heat, and, after it has been applied, the gilt surface must be varnished over.

Artificial Marble.—This can be made by soaking plaster of Paris in a solution of alum; bake it in an oven, and then grind it to a powder. In using, mix it with water; and to produce the clouds and veins, stir in any dry colour you wish. It will become very hard, and is susceptible of a high polish.

Marine Glue.—This glue is employed where the materials are exposed to the influence of wet. It cements not only wood, but glass and metals. It is made by dissolving by heat, one part of pure India-rubber in naphtha; the India-rubber being cut very small. When melted, two parts of shellac are added, and the melting continued until the whole is well mixed by occasional

stirring or shaking. While hot, it is poured on metal plates to cool. Before using, it requires to be liquified by heat, and quickly applied with a brush, as it soon hardens.

Gold Varnish for Frames.—Take of turmeric and gamboge, of each 1 drachm; spirit of turpentine 2 pints; shellac and sandarach, of each 5 ounces; dragon's blood, 7 drachms; thin mastic varnish, 8 ounces. Digest with occasional agitation for fourteen days in a warm place, then set aside to fine, and clear off the pure liquid. This is to be applied on the frames previously silvered.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply. All answers should reach us before the 12th of the month.

317.—Styrax.—What are the advantages of mounting in liquid styrax? M.A.

318.—Fish Skin and Scales.—What is the best way to mount the skin and scales of fish to show to the best advantage with or without polariscope? H.

319.—Sections of Teeth and Bone.—What is a good medium to mount hard sections, such as bone, teeth and horn, one in which they will not change, or their minute structure will not be lost; that is lacunæ, canaticuli, and dentinal tubules, etc.? Balsam obliterates and glycerine has a solvent action on the lime salts. A.B.

320.—Arranged Diatoms.—What is the best size for holding diatoms in arranged slides? STELLA.

321.—Cleaning Diatoms.—What is the best method of eliminating flocculent matter from diatoms after boiling? DIATOM.

322.—Bleaching Diatoms.—What is the best bleacher for diatoms to be used when boiling? DIATOM.

323.—Barbados Earth.—Will any reader give the best and easiest method for breaking down Barbados earth before boiling? S.

324.—Rusty Pork and Bacon.—Will some one tell me the cause of bacon and pork turning rusty, and how to prevent it? I should also be glad to know what the "rust" is; is it a chemical change in the meat, or is it caused by a fungus? P.I.G.

Correspondence.

To the Editor of the "Scientific Enquirer."

DEAR SIR,—

I am glad to learn that you have met with such help as will allow you to continue the publication of the SCIENTIFIC ENQUIRER.

Could you induce one of your specialists to write a paper on the "Connection between *Angular* Aperture, and *Numerical* Aperture," for either the *Journal of Microscopy* or *Enquirer*. I am a subscriber to both.

A practical paper, clearly written for the average amateur, explaining the mathematical and other signs used would be of great value.

Yours faithfully,

F. R. B.

[We shall be glad to receive such a paper.—ED.]

Reviews.

PHOTOGRAPHY SIMPLIFIED: A Practical Treatise for the use of Amateurs or Professionals. Third edition. Cr. 8vo, pp. xii.—160. (London: Mawson and Swan, 33, Soho Square. 1887.)

To the amateur photographer this little book will prove of much service, containing as it does hints on the selection of apparatus and on general practice. It treats each department in a very thorough manner, whilst the instruction given will be found to be plain and practical. At the end of the book will be found a complete set of bottle-labels for all the chemicals required in the laboratory. The price, 6d. or 9d., will insure for this book a large sale.

THE SELBOURNE MAGAZINE: For Lovers and Students of Living Nature. Issued by the Society for the Protection of Birds, Plants, and Places. (London: William Rice, 86, Fleet Street.)

The first number of this magazine opens very fittingly with a paper on Gilbert White, of Selbourne. Other papers are on the Teaching of Elementary Botany in Schools; Local Museums and the Observation of Living Nature; An Open Aviary; Notes of the Month; Wild and Tame Doves; etc. On the cover of the magazine is a copy of rules to be submitted to the members of the society at their next meeting.

SCIENTIFIC NEWS for general readers. Nos. 1 and 2 of this new weekly have been received. Our friends will remember that last year it appeared as a monthly. We do not look upon the SCIENTIFIC NEWS by any means as a rival, but hail it as a friendly ally, and as a proof that a desire for scientific knowledge is steadily increasing, and therefore have much pleasure in recommending it to our readers. Many of its articles will be found of much interest.

THE NATURALIST'S MONTHLY. Edited by Dr. J. W. Williams, M.A. (London: Walter Scott.)

The numbers for December and January are before us, and contain a well-assorted series of articles of much interest to the naturalist, among which we notice papers on "The History of the Theory of Spontaneous Generation, Phosphoresence," etc.

ROUTLEDGE'S ALMANACK FOR 1888. Cr. 8vo, pp. vi.—386. (London: George Routledge and Sons.) Price 1s.

A compendium of useful and interesting information concerning our own and foreign countries, etc., with a Review of the Musical, Scientific, Artistic, Ecclesiastical, Dramatic, Sporting, and other events of the year. It contains also an Obituary and a Table of Notable Events in 1887. The sections are all arranged in alphabetical order, thus making them much more convenient for speedy reference; there is also a carefully-prepared index.

OUR CHILDREN: How to Keep them Well and Treat them when they are Ill: A Guide to Mothers. By Robert Bell, M.D. Pp. 232. (Glasgow: David Bryce and Son. 1887.) Price 2s. 6d.

A most useful little work, very clearly and concisely written, and so free from technicalities as to be within the comprehension of any reader. It treats of Diet, Hygiene, Teething, and all the ailments to which children are subject, with general hints with regard to the administration of medicines.

AWAKENED. By F. M. Skene. (London: James Clarke and Co. 1888.) Price 1s.

This is the "Christian World" Annual for 1888, and is an interesting tale in nine chapters.

THE DAY OF DAYS ANNUAL. Vol. XVI. Conducted by Rev. Charles Bullock, B.D.

HOME WORDS FOR HEART AND HEARTH. Conducted by Rev. Charles Bullock, B.D. (London: "Home Words" Publishing Office, 7, Paternoster Square.)

These are two exceedingly nice annual volumes for children, specially adapted for Sunday reading. Both are nicely illustrated, and our little friends will find them full of interest.

THE "A 1" BOOK OF DIALOGUES, Charades, Set Pieces, Entertainments, etc. Edited by Alfred H. Miles. (London: Simpkin, Marshall, and Co.) No. I. Price 6d.

We hail this new work with much pleasure. It contains pieces suitable for two, three, four, five, or more performers, the first piece being the celebrated trial, BARDELL *v.* PICKWICK. The part before us contains in all 36 pieces.

EVERY BOY'S ANNUAL. Edited by Edmund Routledge, F.R.G.S. (London: George Routledge and Sons. 1888.)

We know of few books with which boys are more pleased. Besides tales of stirring adventure, it contains a number of instructive papers on such subjects as Earthquakes, a Naturalist's Holiday, a Story of the Arctic Regions, Famous Artists, etc. The book is very attractively bound and well illustrated.

The Scientific Enquirer.

FEBRUARY, 1888.

*Evolution in the Orchards.**

By E. P. P.

I HAVE my family around me in my cottage, and we are a number of rather decided individualities, each one with peculiar features and tastes; but in my orchard there is a family of about the same age that is decidedly more positive and peculiar in its idiosyncrasies. The great rose family includes not only the rose and the briars, but the apples and the pears, and plums and cherries. Of these the apples and pears are generally associated in the orchard and are most closely related. Yet they must have come off from the parent stock at very different periods. I mean that the old rose ancestor had children that were apple-like and apple progenitors before it had pear-like children that were progenitors of the pear. The apple has certainly a much longer history than the pear, and has been much longer undergoing a civilising process. You can see this in the fact that the pear reverts to thorn-producing very uniformly, while an apple is rarely found that has a trace of this primitive characteristic of the whole family. For at the outset not only rose-bushes were thorny, and blackberries and raspberries thorny, but apples, pears, and all the rest of the cousins. The reason that some of them are not thorny to-day is that they have for a longer time been in possession of man, and not needing thorns have learned to leave them off. It is decidedly for the advantage of any bush or tree that has become an associate of man not to be thorny; for man is certain to reject the more thorny for the less thorny. While not objectionable to other fruit-eaters, thorns are very much in man's way. The result will be that in time such a characteristic will be eliminated from all fruits that are cultivated.

The raspberry has already made some moves in that direction till we have some excellent varieties that are nearly or quite thornless. If a new variety shows itself among blackberries that has left off its terrible barbs it will be sure of survival as one of the fittest things in the garden. So we say the pear has not been with

*From *The Kansas City Review.*

man as long as the apple has, because it has not learned to adapt itself so well to man's requirements.

The relative age of the pear and apple under civilisation is also determined by the fragments found in the refuse heaps of the old Stone Age and the Swiss Lake dwellers. In their "kitchen middens" not more than a handful of fragments of pears have been found, while apples are discovered in abundance. As an ancient fruit it was a very small and almost worthless affair, and occupied but a limited area. Pliny and the poet Horace both refer to the pear, and Pliny says very explicitly that it could not be eaten unless cooked. So that historically the pear has a meagre record, while the apple has a name in almost all languages, and is referred to by many writers as a notable fruit.

As true dessert fruits the pears date back only to the middle of the last century. The apple, on the contrary, is one of the oldest of eatable garden productions, dating back many hundreds of years, not only in Europe, but in a large part of Asia. It seems to have been brought into Europe by the earlier Aryans in a somewhat improved or selected state. At present we find in our orchards as a result of more recent selection a large number of special branches of the stock—varieties they cannot be called, as each group contains innumerable varieties, and those not species became established long before any pear was worthy of classification as a dessert fruit. The pippin got its blood so thoroughly fixed 200 years ago that its seedlings are distinguishable to-day all over the world. That is, in an orchard of seedlings, or in a wild thicket of apples, a good horticulturist is likely to find apples easily distinguished as descendants of the pippin line. They may be quite out of direct descent, and cross-bred to many degrees, yet by flavour, colour, texture, shape, core, seeds, sutures, stem or otherwise, it is easy to determine the ancestry to be remotely pippin. Such family groups of pears we have, but very much less firmly established. When a variety of any fruit gets to be so positively traceable in descent we may be sure that it has been for a long while undergoing selective influences. Nothing is so hard to settle down to fixed idiosyncrasies as a sub-species. Break up a type and the tendency for a long while is toward infinite variation. Instability governs form or colour or quality, or all these and other characteristics. I have over 200 cross-bred varieties of beans, which I have produced within four years. The trouble now is to fix the characteristics of any one of them, and stop the further propensity to crossing. The apple, however, has for a long while had what may be called horticultural species, one of which I have referred to as the pippin; others are the bellefleur and gillifleur.

The apple has been so long man's companion and under the control of man that it has not only lost all recollection about thorns,

but has been in many other ways civilised and refined. Now, our word culture, as applied to people of a long line of educated generations, is a word borrowed from tree-growing and plant-growing. A tree is cultivated, that is, educated, by man's wisdom and skill. As a matter of fact, nature never quite forgets what she has once done. She likes to rehearse, just as we like to tell what we did when children. The frog never gets to be a frog until he has gone over his ancestral history as a tadpole. So the pear, if you sow the seed of a Sheldon, runs back to its way of doing 10,000 years ago; only it may be that one seed in a hundred will tell the other story of progress. But the apple has very much less of this propensity to far backward looking. It is quite settled down to be content with civilisation, and has even forgotten a good deal of what it once knew.

Now, we know that the great rose family, including pear, apple, quince, plum, almond, peach, apricot, rose, strawberry, and blackberry, is peculiar in this, that it has developed a power to bribe insects and animals to do it some sort of service; for that really is what the strawberry and the apple and the other edible seeds are. They are temptations to induce the birds to eat them and so carry the seed about and sow them, and in that way enable them to spread and multiply. This bribing family never appeared on the earth until fruit-eating birds appeared—that is, the fruit-eating birds and the fruits for them to eat were created by evolution together. But, while it was a part of the business of these trees to get their fruits eaten, it was equally a part of their business not to get eaten themselves, therefore thorns were quite as necessary as nice apples and berries. The seeds evolved a power to swell out into receptacles of a pulp and juice agreeable to the birds, but they protected themselves against the browsing of animals as vigorously as they welcomed their feathered friends. The raspberry puffed out the whole ovary; the strawberry the seeds and ovary both. There was but one exception in the family to the thorn-producing. The strawberry or potentillas, nestling close to the ground, got a habit of running away from enemies and hiding, and so did not need to barb the noses of intruders.

And this went on after a simple sort for thousands of years. Strawberries, however, were but little more than dry seeds; and apples were only haws and other very insignificant things. But by and by man appeared on the scene, and though he at first had but little more taste than the other animals, he had just one thing more, a power to educate his taste. And as he educated his taste he took the rose family out of the hands of nature and began to educate that too; just as he began to educate the wild beasts and make them tame ones. It was slow work, both with himself and with his pupils. All the steps we can't trace. But here we both

are after 100,000 or 200,000 years, and the result is quite satisfactory.

The bribe that the pear and apple offered at first to the birds and animals is largely withdrawn from them and offered now to man. They don't care whether animals like them or not, if they can only gratify our palates. I mean they don't much care, the really civilised members of the family do not. The apple, especially, has got quite used to catering for our markets. And the pear will after awhile get to be of the same mind. Of course there are a good many barbarous branches of the family, as there are savage tribes of men; and they will just be grafted, for it won't pay to work at them in the slower way of natural selection. Still once in a while the survival of the fittest gives us a Seckel pear right out of a wild tribe like Red Jacket or Scenondo among aborigines. So the apples, pears, and berries of to-day are such as suit the palates of men and not of the birds.

But that is not all; they do not any longer have to protect themselves against being eaten up, and so they have stopped growing thorns. The apple tree has found out that it is safe enough without growing thorns. It is men's interest to protect it. And the pear after a few hundred years more, or may be less, will find out the same fact. A good many have already settled down to a thornless way of growing. Gradually everything takes into consideration man's habits and tastes and fits to them.

Will the roses shed their thorns also? Some of them, those longest in man's company, have already done so; but the tendency in some species or varieties to revert to thorns in seedlings is yet very marked. This will all be forgotten in time. And by and by our gardens will surely contain only varieties of berries that any lady can pick without being troubled with a survival of barbarous characteristics. The thorns will all be gone.

Now, I want you to observe the tendency of evolution in another way. It works in the same way with apples, and pears, and roses, and men. I mean the tendency to individualise or concentrate its form, not on number, but on quality. This innovation came in when man was created, but it was passed over slowly to everything else that comes into man's closer association. Here is a wild-thorn apple growing beside a Northern Spy. In May they are equally profuse in bloom, because blossoms are for the eyes of insects as well as men; and the insects must be attracted to do an enormous amount of fertilising, and take their pay in beauty and honey. But in June the flowers are all off. The Northern Spy forgets about the birds and thinks only of man. So it throws away nine blossoms, and with the remaining one it goes to work at producing a great apple that shall be picked in October by man, and eaten by him, and so please him that he will protect

that tree and graft it everywhere. On the other hand, the wild apple does nothing of this sort. It does not know man nor consider him ; it is a wild, untamed nature, and still thinks only of the birds. So for every blossom it produces a fruit, but every fruit is a little hard, bitter affair that no man can eat. Here you see nature is making in the Spy the high-bred, costly individual, and this is what has lately been going on in our orchards ; just as in modern society the aim is to bring out superb men, instead of masses of human beings. But what of the wild haw or thorn apple ? It has fallen under culture in another direction. Man does not care to educate its fruits, but he has found that he can educate its blossoms. Some haws and other thorns were found to vary slightly in colour and size of flowers, and as man lives not only to eat but to see fine things, he has selected these to be preserved, and so we have now scarlet-flowering and double-flowering crabs and haws.

But all this while man himself has been a creature of evolution quite as much as the things he cultivates. His senses, and especially his taste, has grown to be a very different affair from what it used to be. He will not eat now what a few generations ago was eaten with satisfaction. It would be hard to bribe a party of horticulturists to eat a Bon Critica pear, that fifty years ago was readily eaten by their fathers ; or a belle pear, whose name indicates the opinion held about it. It is not unlikely that fifty years from now, that prince of good pears, the Sheldon, will be quite behind the cultured palates of our children. There are doubtless bad flavours in the Seckel and Anjou that you and I cannot discover, but which will some day be fully apparent to daintier tastes. Evolution is a purpose in nature that aims at better things all the time, and so it makes men as well as men's foods to improve.

Daintier birds as well as daintier men are the result, and always will be the result. And then daintier fruits will be needed, and whatever is needed will be sure to be supplied. And so it will go on, better men demanding better foods ; better fruits demanding better men. The possibilities hidden in this grand rose family are almost as great as those hidden in man himself. The quince, which is also one of the same family, has a hint of some wonderful things that may not be brought out in long ages. The berries are marching on very rapidly. We shall have strawberries, in time, as large as eggs, and richer in flavour than we could now appreciate if we had them. With daintier men come daintier birds. Robins are one of the more fastidious sorts that have grown up as a result of man's culture. He will, on a pinch, eat a great many poor fruits, but he knows a good one when he can get it. He lives with us, not because he admires us, and our cats, and wicked boys, and

ornithologists, and specimen hunters, but because he has a taste educated to the fruits he can only find in our vicinity. He is spoiled for wild life. Indeed, the robin red-breast is purely a product of civilisation, appearing only with man. And the cat-bird is being spoiled as fast as possible, for anything short of the finest cultivated raspberries and green peas. And we have several more birds on the same road. They can eat the old bitter berries when driven by hunger, but they have learned to know good fruits when they find them. The same is true, unfortunately, of some pestiferous insects.

So, you see, our apples and pears are members of a very curious family, and have a very interesting history, and a great future ahead of them. The two families that move along together, the very highest representatives of the culture of the vegetable kingdom and of the animal kingdom, are the rose family and the human family. Indeed, neither one could have become quite what it is but for the other. And if to-day the rose family should be obliterated, I think it would go very hard with us to keep up our civilisation.

Use of Spines in Cactuses.

OUR brethren across the water, assuming that thorns are simply for protection in a military sense, are exercising themselves in their serials over the spiny leaves of the holly. When young and vigorous—*i.e.*, in early life—the teeth are very spiny; when the tree is aged, and the branches then a distance above the surface of the ground, losing the vigour, the spines are weak or absent. Sir John Lubbock and others, following the poet Southey, see in this a beautiful adaptation for protective purposes. When within the reach of animals, spines are borne; when high up where animals cannot reach, spines are unnecessary. Numbers of species of plants have mucronate points to the leafy serrature, which are wanted in maturer years. It is at any rate difficult to imagine why a sharp point should be made especially for protection, and points less sharp for no protective use at all.

I have often reflected on a fact referred to by Dr. Newberry, that our thorniest plants are in much greater proportion in places where animal life is scarce, and the immense police force sustained by the great vegetable community absolutely thrown away. Cactuses and other thorny things I have seen covered with thorns and spines on deserts where the hot air seemed to be bounding up and

down like the surging ocean, and where not even a lizard could have dared to show its face. Thorns cannot be, so I have thought, for protection where the climate gives all the protection desired. I am not one who doubts that Nature has a purpose in every move she makes, but the main purposes I think we seldom reach, and that we do ourselves an injury in research by assuming mere incidental uses as the main purposes for which structures seem to be "adapted."

One of these uses in the spines of cactus has occurred to me. They break the full force of the sun on the plant, a force it is made to endure and not to love, as we know who have learned to cultivate it. Plant-lovers set out their treasures in summer under "arbors" of fish-netting or galvanised wire, and those who have no experience would be surprised to find how the moving shadows of the twine or wire lower the temperature. A mass of spines on a cactus must have the same effect. A cactus does not need much light on its epiderm to keep healthy. On the dry mesas along the Uncompahgre River I have seen some aggregated masses of *Echinocactus phœniceus* forming dense hemispheres a foot high and as much wide, with spines so thoroughly interlaced with spines as to rival the hedgehog, and leaving not a particle of the green surface visible; and there are species not cæspitose, such as *E. pectinatus*, which no one can see for spines without cutting apart, and forming a complete protection from the hot suns under which they are doomed to live.

I do not suppose I have yet reached the final purpose of spines in a cactus any more than we have the final purpose in the existence of the cactus itself, but that one use of cactus spines is to furnish a partial shade I feel to be beyond a doubt.—Thomas Meehan, in *Bull. Torrey Botanical Club.*

Short Papers and Notes.

A Lesson from the Flowers.

THE inevitable result of excessive display is impoverishment and degeneration. Some plants which have blossomed beyond their strength grow weak and die. The pretty lady's-mantle, the violet with its retiring flowers, and many other familiar ornaments of the garden and field, present unmistakeable evidences of retrogression. It is well known that bulbous plants, such as the lily or tulip, will not produce nearly such fine flowers if left to blossom year after year

as they would were the flower-spike cut off for a year or two. Fruit-trees which bear heavily one season are rarely so prolific the next, and plants of any kind that are permitted to put forth foliage and flowers with unchecked exuberance will sooner or later deteriorate. On the other hand, flowers which abstain from undue display and husband their resources are enabled to hold their own, while conferring great benefits upon those creatures which know how to utilise them. Some of our most useful roots are obtained from plants that are scarcely ever admired for their beauty. The carrot, for example, in order to meet the demands of the flowering process, lays up beforehand a large quantity of nutritive material in the form of a taproot, on which the plant would feed were it left until the period for flowering and seeding arrives. Again, many valuable trees, such as the oak, hazel, and chestnut, which require a great deal of pollen in order to ensure fertilisation, do not lavish their strength on gaudy flowers. Such flowers as store up nutritive material for after use as well as present charms of colour and form while doing so, are obliged to curtail luxuriance in other directions, or they would soon perish in the great struggle for existence. Many of our most welcome spring blossoms are of this kind. The coltsfoot, blackthorn, jasmine, Daphne or mezereon, and the Japanese apple, now so often trained on the walls of English gardens, usually put forth their blossoms before the leaves appear. Their energies are thus economised, and they are able to produce, without exhaustion, flowers which, if not of extraordinary splendour, are yet universally admired, and that, too, at a time when the earth is grim and well-nigh bare. Another point to be observed in this connection is that lavish display is sure to incite others to enter into competition with it. Hence arises a struggle for precedence which must result in anxiety and waste, while noble powers that might, by prudent exercise, have been productive of incalculable public benefits, are exhausted in foolish efforts after self-aggrandisement, or are perverted into a positive pest to society. Dr. Hugh Macmillan informs us that "when plants are struggling with each other for the possession of the soil, some species must be so crowded that they cannot develop themselves freely; and, therefore, owing to the exhaustion of the soil and the pressure around them, they must produce abortive branches or thorns." The vegetable tissues that might have become etherialised into the snowy, fragrant blossom, beautifying the landscape and delighting the beholder, are aborted into uncomely spores and hurtful prickles. Thus are we taught by the silent ministry of the flowers that, in order to win the respect of our fellow-creatures, and to avoid provoking the jealous criticism and the hurtful rivalry of those who could not submit to be thought our inferiors,

we must abstain from self-assertion, and throw upon our accomplishments and talents the delicate veil of modesty.

Production upon Wood of Photographic Proofs destined for Engraving.

The block of wood is first covered with a layer of gelatine (0·39 grms. to 0.31 grms. of water) by means of a soft brush. When this coating is dry, it is covered, in the dark, with a solution prepared of (1) red prussiate of potash, 7·80 grms., and water, 62·20 grms.; (2) ammonia-citrate of iron, 9·10 grms., in 62·20 grms. water. These solutions are mixed and filtered, and the mixture is kept in the dark. When the layer is dry, it is exposed under a negative for from ten to twelve minutes, and washed with a soft sponge, when a blue tinge appears. If thus prepared, the coating does not peel off under the graver. V. A. Latham.

The Luminous Organs of Insects.

Dr. Dubois has investigated the light-emitting organs of the *Cucuyo* or *Pyrophorus noctilucus*. They are three in number—two prothoracic and one ventral. The prothoracic plates give a good illumination in front, laterally, and above, and serve when the insect walks in the dark; when it flies or swims, its fine abdominal lantern is unmasked, throwing downwards an intense light with much greater range. The insect seems to be guided by its own light. If the prothoracic apparatus is quenched on one side with a little black wad, the *Cucuyo* walks in a curve, turning toward the side of the light. If both sides are quenched, it walks hesitatingly and irregularly, feeling the ground with its antennæ and soon stops.

The light gives a pretty long spectrum from the red to the first blue rays, is more green than the light of *Lampyris noctiluca*, and is incapable of photography, but does not develop chlorophyll. No distinct electric action could be traced to the organs. The luminosity does not depend upon oxygen in air, in pressure under one atmosphere, and in compound oxygen. The organs are still brilliant when separated from the body, but the power of emission appears to depend upon a supply of water, and it is recoverable, after thorough drying, upon putting the organs again in water. Dr. Dubois found that the photogenic substance is an albuminoid, soluble in water, and coagulable with heat, it entering into contact with another substance of the diastase group. Part of the energy liberated appears as light.

A Reasoning Lobster.

While at Bird Island, Buzzard's Bay, Mass., I noticed what

seemed to point at reason rather than instinct in the lobster. One had his home for a time in a hole under a rock where the water was about five feet deep. Thinking to catch him, I made a noose at the end of a fish-line, and by means of a stick spread it carefully around the hole ; then let down a piece of menhaden, holding it six or eight inches in front. The lobster soon reached out to take such a nice morsel, when, by jerking the string, I had him noosed around one of his big claws near the end ; but after I had him half out of his hole the string slipped off and he got back. However, I had no doubt of catching him the next time, so, spreading the noose as carefully again, and again letting down the piece of menhaden, I awaited results, when, instead of boldly putting out his claws as before, he first put his feelers through the noose, and with a waving motion felt the string all the way around, then rooted one claw under the string and grabbed the bait. I finally had to give up all thoughts of getting him, and came away firmly believing that until this fellow dies of old age, the lobster will not be exterminated in our waters.—W. Nye, jun., in *Bull., U.S., Fish. Comm.*

Making the most of Nature's Hot Springs.

In the Yellowstone country a large hotel is erected upon a great geyser terrace, and a dormant water-crater is the receptacle for all the house-drainage ; and in the same romantic region the Chinese laundry-man attached to one of the hotels gets through his labours by throwing the clothes into a bubbling, frothy pool, and fishing them out when they have been tossed about enough. Eggs are often boiled in the Iceland geysers, and bacon is fried on the Hawaiian lava streams. In the Rotorua area of New Zealand the banks of the lake are so perforated with springs that every native hut has its own natural boiler, which is used as a kitchen. The Kuirua spring is strongly alkaline, and, on account of its saponaceous qualities, is utilised as a general wash-tub. In Iceland to cook food in the geysers is a regular portion of the tourist programme. Tea is infused with water from the Great Geyser, and trout are boiled in the Blesi, or hot-water pond, which suddenly ceased to erupt after the Skaptar-Jökull convulsion of 1784. They require to be immersed for about twenty minutes to be cooked to a turn. In the Yellowstone country a story is told of a fisherman, who having hooked a fine trout merely turned on his heel, and, without taking his captive off the line, plunged it into a pool of hot water, from which in a short time he drew it ready for his meal, reminding us of Lord Lovat, the Jacobite rebel, who, when luncheon-time approached, betook himself to a fall on his estate famous for its leaping salmon, and placed a cauldron of

boiling water in such a position that a fish missing its spring would tumble into the pot. Neither story may be true, though there is nothing improbable in either. M. Leclercq narrates how two Irishmen tried to cook their dinner at the Strockhr, in Iceland. A shoulder of mutton was wrapped in the body of a flannel shirt, and in each sleeve a plover was placed, and the load dropped into the geyser. After waiting for half-an-hour, the shirt (with its contents) was hurled up high into the air, and landed on the brink of the basin. The mutton was "cooked as in England," the French writer discreetly observes. But nothing was left of the birds except skin and bones. All colour had fled from the shirt, though the fabric remained uninjured. The hot-water basins both in the Yellowstone and in New Zealand are in great demand as bathing-places. Towards the close of the fourteenth century, Nicolo Zeno saw Icelandic monks heating their rooms with the thermal springs in Julianehaab District, in South Greenland. To make a washing-tub of a crater is to utilise the forces of Nature to the utmost limits of prosaicism.—*From "Our Earth and its Story."*

Right-handedness.

Around the youthful pupil stand parents, nurse, preceptor, all anxious that he should leave off the use of the "wrong hand," either in labour, or as a matter of courtesy. So persistent and universal is this education that some authorities have deemed the whole difference between right and left hand an affair of fashion; and that if both hands were educated alike, it would be a great gain. . . Nevertheless, if right-handedness be a fashion, it is all but universal, and the most ancient fashion we know. The history of writing, the evidence of language, and the drawings and tools, not only of Egyptians, Assyrians, Greeks, and Romans, but of races the memory of whose existence had passed away ere the earliest extant records had been penned, and whose rude tools, and weapons, and artistic representations have been disinterred from caves, kitchen-middens, and crannogs, give us early evidence of right-handedness. These drawings represent faces in profile, looking towards the left, just as a street Arab, unless he be left-handed, chalks them on any unoccupied surface. Such is a sketch of the mammoth, on a piece of ivory, found in the rock-shelter at La Madeleine, in the Dordogne. So, also, is the reindeer, etched with great spirit and skill on bones procured from a cave near Bruniquel. Another drawing, in which an eel, two horses' heads, and what Dr. E. B. Tylor has pronounced as possibly the earliest known portrait of man, represents the implement held in the right hand. Professor Daniel Wilson has given three engravings of bronze sickles from the lake of Brienne, all constructed for right-

handed men of the Bronze Period. One such handle, found in 1872, was the first example of a complete hafted instrument; and, as Dr. Wilson remarks, is carefully fashioned, so as to adapt it to the grasp of a very small hand, and as incapable of use by a left-handed shearer as a mower's scythe.—*From "Science for All."*

Blackberries.

Perhaps one of the most interesting problems is the inquiry into the reasons why certain plants and animals have been chosen for cultivation by man, and others, apparently quite as suitable, rejected. The blackberry has not found favour. Attempts are at present being made to introduce varieties of this fruit, which, both by appearance and flavour, seem suitable for cultivation. Unfortunately, the blackberry, though dear as a remembrance of our youth, when all things were more or less digestable, does not commend itself to our riper years, from its tendency, either raw or cooked, to produce intestinal irritation. An examination of the numerous seeds in a ripe blackberry shows them to be not, as in currants, gooseberries, etc., smooth and polished, but covered all over with curved arabesque patterns with sharp edges, forming a very pretty common object for the microscope with a low power, but in masses in the intestines undoubtedly out of place. Until, therefore, our gardeners can give us a smooth-seeded blackberry, it is wise to use the blackberry only for the preparation of jelly, after the manner of red currant jelly, or as blackberry vinegar. In these, the seeds being rejected, the delicious flavour of the fruit can be enjoyed without fear of colic or dysentery.

Eggs and Egg-Collecting.

To a casual observer there may be nothing remarkable or interesting, perhaps, in the shape, size, or colour of birds' eggs; yet to the warm admirer of Nature and her works what wonders of design are manifested in the construction of a common egg! These traces of design afford the best possible evidence that there is a supreme agency at work, even if they had been brought to their present state of perfection by the process of evolution. How long would it have taken some of the world's great philosophers to discover the best shape of a bird's egg, in order to prevent it rolling off a flat surface, such as a ledge of rock, when moved by the terrible gusts of wind that sweep over high latitudes, or perhaps roughly moved by the parent-bird suddenly fluttering off to save her life in the presence of danger? Take, for example, the egg of the Guillemot. This is so wonderfully constructed, that if moved it will not roll away, like a marble or billiard-ball, but simply spin round on its axis, the same as a screw or top, showing

admirable adaptability to the exposed situation chosen by this bird for incubation. Birds that build their nests in holes, such as the owl, for instance, lay round eggs, which run no risk of being rolled about and smashed. Were the owl and Guillemot to change positions for a while, the latter would stand a fair chance of speedy extermination, affording a beautiful illustration of the profound wisdom which has been brought to bear in the working out of the grand problem of preservation. As a further illustration, let us take the eggs of the golden or green plover, and consider for a minute their shape, number, and colour. In the first place, like that of the Guillemot, they are laid on an almost flat surface in bleak moorland districts, often on the summit of a little knoll, to preserve them from being swamped by heavy rains. In the second place, they are very large eggs for the size of the bird. How wisely this difficulty is met and surmounted; for all their sharp points meet in the centre, and practically form a square, so that the bird may be enabled to cover them all at the same time; whereas, if she laid five eggs it would be almost impossible for her to hatch them all successfully. He who is curious enough to turn the round end of a plover's egg into the centre of the nest, and walk away a respectful distance, will find on his return the parent bird has discovered the chaos in her little household, and speedily set matters right again. In the third place, the beautiful harmony of colouring of the eggs with their surroundings renders them difficult to find; and still further, the eggs are laid at a season when they are least likely to be addled by snow-storms.—*From "Familiar Wild Birds."*

Experimental Optics.

Lord Rayleigh, the newly-appointed Professor of Natural Philosophy at the Royal Institution, in the place of Professor Tyndall, recently delivered the first of a course of lectures under the above title, illustrated by the electric light, observing that the new light afforded convenient opportunities of experiment that were unknown to Newton, Thomas Young, and Fresnel. Commencing with the question of the enfeeblement of light by distance, he mentioned that it appeared a strange coincidence that two theories so widely apart from the corpuscular or emission theory of Newton (the theory that light consists in particles travelling outward from a source) and the wave or undulatory theory of Thomas Young should both equally be able to account for this phenomenon. Yet on consideration it was seen that in both there was assumed a something travelling outwards from the source, and hence the explanation of enfeeblement by spread in travelling. Practical methods of photometry such as are in common use, with

the "standard candle" as a reference unit, are based on this. Count Rumford's method was shown with electric light against gas. It depended on comparing the shadows of a rod cast from two sources of light, the distance of each source from the rod being measured in inches. In this case the small incandescent light at 130 inches gave an equal shadow to that of gas at 105 inches. When two lights are much out of proportion, it is difficult to measure their relation—as, for example, the sun and the moon; but the most reliable results show that the light of the sun is some 250 thousand times greater than that of the moon. Our eyes so gradually get accommodated to the change from sunlight, through twilight to dark, and to moonshine, that this enormous difference is far greater than most people would guess. In alluding to and illustrating other methods of photometry, mention was made of the work of Fox Talbot, which, the lecturer said, was overlooked too much, because his papers were concise and short, and therefore had not that appearance of learning which long papers nobody read usually conveyed. In the illustrations of the laws of reflection the sharp definition given to the electric lantern was observable in a very marked manner. It was mentioned that the silver mirrors in astronomical telescopes now used reflect 95 per cent. of the light, polished steel giving about 50.

Photographic Notes.

Washing Prints with the aid of Iodine.—The Paris *Moniteur* states that Mr. Oakley is accustomed to use iodine to get rid of the last traces of hyposulphite in paper prints. His manner of procedure is very simple:—To the washing water he adds a small quantity of the tincture of iodine, which gives to the back of the print a slight bluish tint; he then continues the washing until the tint has disappeared. We know that in the presence of hyposulphite of soda, the blue tint (which is due to the action of iodine on the starch in the paper) cannot be produced.

Photographers' Paste.—Water, 900 parts; glycerine, 100 parts; starch, 100 parts. Dissolve with the aid of heat. Cardboard does not cockle when this paste is used.

Instantaneous Magnesium Light.—It is said that an instantaneous magnesium light may be obtained by mixing 12 parts of chlorate of potash, 6 parts of magnesium in powder, and 1 part of pirocyanuret of potassium. On applying a light, this mixture gives a sudden flame, very brilliant, which lasts from one-thirtieth to one-fiftieth of a second where small quantities are used, and it is asserted that the light produced is more intense than that of

magnesium, either in wire or ribbon, when burnt in the air.—*Philadelphia Photographer.*

Practical Hints.

Dry Pocket Glue.—A valuable pocket glue is made by combining 12 parts good glue and 5 parts sugar. The glue is boiled in the usual way till thoroughly dissolved; the sugar is then put in, and the mass is evaporated till it is found to become hard on cooling. Lukewarm water melts it very readily, and the article proves useful for many purposes.

To Restore Faded Writing.—Professor von Bibra finds that the best method to restore faded writing is to brush over it a moderately concentrated aqueous solution of gallo-tannic acid, wash with water, and dry the MS. at a temperature of about 150° Fah. If the writing has been done with any ink containing iron, it is revived in clear and very black characters, which retain their colour for a long time.

To Transfer Engravings.—Soak the engraving to be transferred in water for a few minutes, then dry between two sheets of bibulous paper. Pass over the part to be transferred a coating of white varnish, made with the finest alcohol, which may be procured from any colourman. Should the first coat of varnish be absorbed, give a second coat; then quickly apply the engraving, using a cloth to make it thoroughly adhere to the body to which the transfer is to be made. Allow to dry for four hours; then wet the back of the engraving, and rub with the finger, a sponge, or a cloth, to remove the paper, until the image is seen with all its details. Give a coat of the same varnish, and allow to dry.

To Mount Starches.—The following *formula* is taken from Dr. Beale's "Microscope in Medicine" 1878:—Anilin blue, ½ gr.; Distilled water, 1 oz.; Alcohol, 25 drops. Make a mixture of equal parts of glycerine and water, to which add a very little acetic acid, only two or three drops to 1 oz. To this mixture of glycerine add the anilin blue solution until the mixture is of a decided blue colour; a drop of this placed on a slide and some of the starch is dusted on the top, which is done by touching the starch with a camel's-hair pencil, and then slightly shaking the brush over the top of the *coloured* glycerine. The starch sinks in and mixes; the cover is applied, pressed down quite firmly against the slide, and all excess of the glycerine removed. The slide is then transferred to the turn table and then a layer of dammar or balsam

in benzole is placed round the cover. This soon hardens and maybe finished with zinc cement. The starch does not stain, but is surrounded. V. A. LATHAM.

Answers to Queries.

317.—Styrax.—According to A. C. Cole, styrax is a perfect substitute for balsam, and its solution easier to work with and more permanent and durable. The *Journal of the Royal Microscopical Society*, June, 1884, gives the refractive index of styrax as 1·585, showing a considerable advantage over balsam. A. N. T.

317.—Styrax.—I much prefer Styrax to any other medium, especially when mounting diatoms. I have made a series of experiments with some sixteen other media, but none have proved so satisfactory for cleanliness and clearness of resolution. A. W. G.

320.—To Arrange Diatoms.—In arranging Diatomaceæ for the microscope, the slide should first be dusted with gum finely powdered, and as the diatoms are arranged, by gently breathing on the slide they will become fixed. V. A. LATHAM.

320, 321, 322.—Diatoms.—Your correspondents would do well to procure copies of the *Journal of Microscopy* for July and October, 1884, containing papers by Mr. Griffin, on the "Collection and Preparation of the Diatomaceæ." S. B.

321—Arranged Diatoms.—Diatoms may be arranged in lines or patterns in two or three ways; one of which is that a thin solution of isinglass is made in hot water, and lightly brushed over the centre of the slide, and when nearly dry the Diatoms are arranged upon it, according to desire; the cover-glass is placed upon it, and a drop of Canada Balsam in Benzole, or Styrax in Chloroform is placed on the outer edge, when the air is displaced by the incoming fluid, and the isinglass also dissolved away. When, however, the finer varieties of Diatoms are required as test objects, it is well to mount them directly upon the glass cover. Geisbricht's method is as follows:—The slide is coated with a solution of shellac in absolute alcohol, washing over this with oil of cloves, and when the Diatoms are arranged in patterns, warm the slide, and the oil of cloves is soon evaporated, leaving only the work to be done of putting on the cover-glass, and the filling in with either of the two mentioned media. A. W. G.

321.—Cleaning Diatoms.—The sediment must be poured into an evaporating dish, with sufficient pure Sulphuric Acid to cover it, and the vessel gradually and carefully heated. To avoid any chance of explosion, so soon as the white fumes of the acid appear, Bichromate of Potash should be added in small portions, and when the green colour formed by its reaction on the organic matter begins to assume a yellowish tint, a few drops of Hydrochloric Acid must be added. The liquid should now be set aside to cool, when the deposit must be finally washed as has been already described. There is another process which is substantially the same as the one already described, but with this exception; Sulphuric Acid is substituted for Nitric Acid, and crystals of Nitrate of Potash for those of Bichromate. This has, I think, some advantages over the first-mentioned process, and, as I invariably follow it, I have the greatest confidence in recommending it. When a recent gathering is nearly pure, all that is required is to burn them on a platinum plate over a glass flame, the organic matter being quickly carbonised, while the beautiful siliceous shields alone remain unaffected. A. W. G.

319.—Sections of Teeth and Bone.—Sections of teeth often show very well when mounted in liquid balsam, thinned with benzole. With *bone sections* it is different; the canaliculi disappear, and the lacunæ look like ghosts when thus treated. There can be no better way of mounting bone sections than that given by Carpenter ("the Microscope," etc.), and, in almost the same words, by Hogg. He (Carpenter) says:—"A quantity of balsam, proportioned to the size of the specimen, is to be spread upon a glass slip, and to be rendered stiffer by boiling (baking in a moderate heat?) until it becomes nearly solid when cold; the same is to be done with the thin glass cover; next, the specimen being placed on the balsamed surface of the slide, and being overlaid by the balsamed cover, such a degree of warmth is to be applied as will suffice to liquify the balsam without causing it to flow freely, and the glass cover is then to be quickly pressed down, and the slide to be rapidly cooled so as to give as little time as possible for the penetration of the liquified balsam into the lacunar system." Carpenter adds that the same method may be employed in mounting sections of teeth, and so, no doubt, it may, and with advantage; but with *bone*, unless the balsam can be kept out of the lacunæ and canaliculi, they are better polished and mounted dry. It is mere misery to see one's carefully-rubbed-down specimens being spoiled by the balsam creeping in. I have mounted scores of bone sections in Carpenter's way, and never

found it fail except by some awkwardness of my own. The difficult point is to know exactly when to press down the cover-glass. Be sure to have at hand some iron or stone slab to cool the slide rapidly. *Fossil bone*, in which the lacunæ, etc., are often filled up with mineral matter, may be mounted in the usual way.

R. S. P.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply. All answers should reach us before the 12th of the month.

325.—Weight of the Earth.—Will some one tell me how the earth is weighed, and its density and mass computed? GEO.

326.—Preparing Rock Sections.—Have any readers of the *Enquirer* succeeded in preparing *good* sections of rocks, for the microscope, *without* the aid of the lathe and diamond powder, and if so how? Or are these requisites essential for success? Also, is there any safe way of transferring the sections to a fresh slide when finished, or otherwise preventing the scratches, which disfigure the slip on which the specimen has been ground down.

G. H. B.

327.—Cultivation of Sundew.—I should be glad to hear of any one who has been successful in cultivating plants of *Drosera rotundifolia;* how they may be grown so as to live for more than a short time. They generally seem to die very soon after transplanting, or live for at most a year. *Pinguicula vulgaris*, on the other hand, can be readily grown in a pot of wet earth, and may be easily reared from the seeds, which it produces freely under cultivation.

G. H. B.

328.—Preserving Entomological Specimens.—Another enquiry on this well-worn subject may perhaps seem unnecessary, but amid all the information given in various books and journals as to the best way of saving insects from the attacks of mites and larvæ, I have been unable to find exactly the information required. Thus camphor is excellent for the purpose, but camphor tends to produce greasiness in certain butterflies. Naphthaline is harmless, alike to the specimens in the cabinet, and the mites or larvæ feeding upon and destroying them. Benzine requires constantly being

renewed, and the same objection applies to bisulphide of carbon, which, however, is excellent for destroying mites if they find their way into the collection. Then there is carbolic acid, which seems fairly satisfactory. Also, there is the plan of poisoning the specimens, with corrosive sublimate, which, however, must be done when the insects are being set, not after, otherwise the specimens get relaxed by it, and care must be taken not to let the poison get near the pin, which it will corrode. Thus it appears that for specimens not poisoned when set, camphor is the only preservative that will last for any length of time, but this is open to the serious objections just mentioned, to which may be added the fact, that grease produced by camphor is very difficult to dissolve. Can your readers suggest any way out of the difficulty? Have carbonate of ammonia or sulphur been tried, and if so with what success? G. H. B.

329.—Tracing Paper.—Will any of your readers tell me how tracing paper is made; what kind of paper is used; what kind of varnish, and the cost of it; how it is to be applied, and how dried? ANXIOUS.

330.—Salt.—Will any physiologist tell us in plain terms why *salt* causes thirst? What is the relation between the action on the stomach and intestines and the parched tongue? Z. S.

331.—Canada Balsam.—What are the various merits of Canada Balsam diluted with (1) Benzole, (2) Turpentine, (3) Chloroform respectively? Are any of these better than or as good (except for the saving of trouble) as balsam thinned by heat? Z. S.

332.—Blood Corpuscles.—What is the use of the colourless blood corpuscles? Kindly also point out their morphological and physiological analysis, especially referring to Amœba, Torula, and various species of Bacterium. B. O. B.

333.—Lobster.—What evidence do we possess that the green gland of a lobster fulfils the office of a kidney? B. O. B.

334.—Octopus.—I have a slide marked "Odontophore of Octopus." Will someone tell me if the animal possesses the usual lingual ribbon common to the Mollusca? R. H. M.

Exchange.

Wanted, Parasites, unmounted, prepared. Will give Slides (Anatomical, Pathological, Botanical, Micro-fungi, Parasites, Zoophytes, etc.) in exchange. Splendid Slide of Bacilli in section of Lung (acute miliary tuberculosus). Home and foreign correspondents wanted to exchange slides or micro material of above or other subjects.—Fred. Lee-Carter, Gosforth, Newcastle-on-Tyne.

Reviews.

PHOTOGRAPHIC MOSAICS: An Annual Record of Photographic Progress. pp. 144. (New York: E. L. Wilson. 1888.) Price 50c.

A handbook of information, most useful alike to the professional and amateur photographer. The first article, entitled "A Few Hints Backward," is written by the editor; it occupies nearly forty pages, and is in our opinion worth the whole cost of the book.

THE WORLD'S INHABITANTS, or Mankind, Animals, and Plants. By G. T. Betany, M.A., B.Sc. Parts 3 and 4. (London: Ward and Lock.)

Chapters 23 and 24, in part 4, describe the European Plants and Animals. The same part contains the opening chapter of Book II., in which will be described the inhabitants of Asia. Chapter I. treats of the Early Inhabitants and History of India; Chapter II., The Europeans in India. The work is well illustrated.

THE LEISURE HOUR. Vol. 1887, pp. 860. (London: 56 Paternoster Row.)

The twelve monthly parts, for 1887, form as usual a handsome and most interesting volume, consisting of serial stories and short articles, on a variety of interesting subjects. Amongst other subjects too numerous to mention are a series of Biographical papers, another entitled Notes on Current Science, Invention, and Discovery, etc.

THE ANIMAL WORLD: An Advocate of Humanity. Vol. 18. (London: S. W. Partridge and Co. 1887.)

BAND OF MERCY. Vol. 9. (Same publishers.)

Two yearly volumes, both issued by the Royal Society for the Prevention of Cruelty to Animals. This Society is earnestly endeavouring to cultivate in the minds of children and adults a reasonable regard towards all living creatures, which is calculated to improve their relations, not only with animals but with human beings. Thus, whilst its primary object is the protection of lower animal dependents, which minister to man's wants, it is obvious that in no less degree it seeks to elevate human nature.

All Naturalists should read the ANIMAL WORLD, and we cordially recommend the BAND OF MERCY to our young friends, especially those who are lovers of animals.

LITTLE WIDE AWAKE: An Illustrated Magazine for Children. Edited by Mrs. Sale Barker. Cr. 4to, pp. 376. (London: Geo. Routledge and Sons. 1888.)

A fine book for children, full of interesting tales, stories, etc., and beautifully illustrated by M. E. E., Phil. Ebbutt, F. A. Fraser, C. O. Murray, Charlotte Weeks, and other artists. The volume is gilt edged and attractively bound.

THE FIRESIDE ANNUAL, 1887. Conducted by the Rev. Charles Bullock, B.D. Roy. 8vo, pp. 762. (London: *Home Words* Office, 7 Paternoster Square.)

The Fireside is a magazine of Home Literature for the Christian family, and consists of a variety of interesting reading, which may be described under the following subjects:—1. The Christian Home; 2. Pleasant Reading for our Sons and Daughters; 3. Science, Art, and Industry; 4. The Month. There are a number of plates and other illustrations.

The Scientific Enquirer.

MARCH, 1888.

*Interesting Data about the English Calendar.**

By W. M. Bogart, Savannah, Georgia.

THE "day on which the year of our Lord in the Church of England beginneth" is the designation of the 25th of March in the old English prayer-books; and this, not in reference to the church year, for that began then as now with Advent, but meaning thereby the civil year. So recently was the change made from this day to January 1st—scarce a century and a quarter ago—that our great-grandfathers kept New Year's Day on this Feast of the Annunciation, and for over four centuries previous in our Fatherland Lady Day had ushered in the new year.

The recurrence, then, of this 25th day of March, now simply a minor festival in the calendar, but to our ancestors full of all the associations, religious and social, of a happy new year, suggests a short article on the civil calendar, and gives me an opportunity to say something of the changes in our modern year, and to explain one or two perplexing difficulties.

The etymology of the Roman names of the months, retained in our own calendar, shows that March was their first month, because September, October, November, and December were respectively their seventh, eighth, ninth, and tenth months. Quintilis and Sextilis, the original names of July and August, testify to the same fact. I shall not dwell on the calendar of Julius Cæsar, save to say that his reform substantially rectified the disorders of the then civil year, fixing its length at $365\frac{1}{4}$ days, and dividing it into twelve months, nearly as they exist now. The quarter-days, neglected yearly, were combined every

* From *Magazine of American History.*

fourth year, and the accumulated twenty-four hours became a new day in these leap years, and was inserted after the 24th of February. This arrangement was correct in principle, but a small error in practice brought back the old disorder, and threatened, in coming ages, to interrupt the regular recurrence of the great astronomical periods.

Let us attempt an explanation. The true solar year is not 365 days 6 hours long, but is about eleven minutes shorter. To intercalate, then, every fourth or leap year twenty-four hours, or a whole day, is to insert about forty-five minutes too much; or, which is the same thing, is to insert the day forty-five minutes too soon, and therefore it hastens by that amount of time the coming of any particular date; say, for instance, the vernal equinox, on the 21st of March. This date well illustrates the point, for it was in reference to it that the Julian calendar had to give way to the modern reform of Pope Gregory. Let us start with the Council of Nice, A.D. 325, in which year the equinox coincided with its true date, March 21st, and but for this annual excess of eleven minutes in reckoning, it would continue always to fall on that day. The true year, however, being eleven minutes shorter than the calendar year, it is plain that the vernal equinox would anticipate its calendar recurrence by this number of minutes every year, or by forty-five minutes every fourth year; and in about 130 years it would anticipate it by a whole day. That is to say, in A.D. 455 the equinox would fall on March 20th; in A.D. 585 it would fall on March 19th, and so on for all subsequent intervals of 130 years. To rectify such a mistake as this, we must needs drop a day in A.D. 455, and call March 20th the 21st; or, if neglected then, we must drop two days in A.D. 585, and call March 19th the 21st.

This is the exact result of the practical error in the Julian reckoning, and what was actually done in his reform of the calendar by Gregory XIII. in the year A.D. 1582, at which time the discrepancy amounted to *ten* days. The Pope ordered the ten days to be dropped in that year by calling the 5th of October the 15th, thus bringing the solar and calendar years together. To keep them together in future, while he kept the old leap-year system, he introduced a compensating device, which averages the losses and the gains, and balances the scheme. This was to make the century years, such as 1700, 1800, 1900, 2100, etc., non-leap years, except every fourth century, such as 1600, 2000, etc., which were to remain leap-years. This scheme keeps the calendar right for all future time.

The Papal countries of Europe at once adopted the Gregorian calendar, or new style; but England persisted in ignoring

the change of style for nearly two centuries, and it was not till A.D. 1752 that she adopted the reform. At that time another day had been lost, and eleven days had to be accounted for. Russia still holds on to the old style, and her reckoning is now twelve days behind the rest of the world.

These are the principles of the English calendar, and in applying them it will be plainer and more interesting to take some special date. For this purpose I select Washington's birthday.

The family Bible records Washington's birth on "ye 11th day of February, 173½," and on the spot where stood his humble home was placed, in 1815, by his step-grandson, G. W. P. Custis, a stone slab inscribed: "Here, the 11th day of February, 173½, George Washington was born." These records fix the date under the old style, and this was the date on which he kept his birthday till he was twenty years old. He would have written it February 11, 1731. It was near the end of that year, about six weeks before New Year's Day, 1732, which was March 25. He would have been twenty years old, then, on February 11, 1751, but that day never came, for the year 1751 ended December 31, and the year 1752 began the next day, January 1, the British Parliament having just changed New Year's Day from March 25 to January 1, and applied the change for the first time to the year 1752. The change simply shortened the year 1751 by taking away January, February, and March, and putting them at the beginning of the year 1752. His twentieth anniversary, then, would fall February 11, 1752.

So much for the year; let us now correct the day of the month. The act of Parliament in its preamble states: "Whereas, the Julian calendar hath been discovered to be erroneous, by means whereof the spring equinox, which, at the Council of Nice, A.D. 325, happened on the 21st of March, now happens on the *tenth* day of the same month; and the said error is still increasing, therefore, etc., etc." It then enacts, in order to drop the eleven intermediate days, that the day after the 2d of September, 1752, shall be reckoned and called the 14th of September, thus making September of that year to have only nineteen days. This change, as well as the one setting back the beginning of 1752 from March 25 to January 1, was naturally applied to all previous dates, and thus Washington's birthday has ever since been known and taken as February 22, 1732.

The dropping of those days gave great offence to the populace of London, as is evident from the caricatures of the time. Those who are familiar with Hogarth's pictures satirising the politics of his day will remember the flag displayed at the

"Election Entertainment," containing the words, "Give us our eleven days," which shows how unpopular this reform of the calendar was, and how it was resented by the people as an arbitrary interference with their social life.

A few words of further explanation will close this article. Dates previous to 1752 are likely to mislead us only in the months of January, February, and March, for these are the only months whose place has been changed. Consequently, in the dates of letters prior to 1752 we often see both years put down, but only in these three months. Take, for illustration, Oglethorpe's letters from Savannah, as published in the Historical Society's collections, where occur the dates February 27, $173\frac{1}{2}$, March 17, $173\frac{5}{6}$, January 29, $173\frac{8}{9}$, etc., all of which, by new style, are to be considered the latter year. As these dates, however, are copies of the MSS. letters, the true days of the month, according to our reckoning, must be obtained by adding *eleven* days to each date. This does not apply, of course, to published dates in English history, for they have already been rectified to suit the new style, of which, besides the case of Washington's, Franklin's birth is an example, whose date is received as January 17, though it is known to have occurred on the 6th.

Ancient Microscopes.

A FEW evenings ago, Mr. Frank Crisp, Vice-President and Treasurer of the Linnæan Society and one of the Secretaries of the Royal Microscopical Society, gave a most interesting lecture at the Royal Institution on "Ancient Microscopes." Mr. Crisp is well known to possess one of the finest collections of microscopes in the world, and to have spent a fortune in making it; and the members and friends were aware also that the lecture would be illustrated by rare specimens of microscopes of bygone make. The audience, which was a large one, spent a delightful hour in front of these strange scientific instruments, under the genial guidance of the lecturer, who explained that a more correct title for his address would have been "Ancient microscopes in their relation to modern thought." Regarding the word ancient as, after all, only a relative term, Mr. Crisp stated that from the microscopist's point of view he designated as ancient those persons who lived more than a hundred years ago, and those microscopes which were made in or before the last century. Before discussing the merits and shortcomings of their ancestors,

modern microscopists were invited to remember what the essentials of a microscope really are. To compare what was with what is requires a standard.

For all present purposes, Mr. Crisp therefore defined a microscope as a thing that magnifies, at the same time admitting that scientifically such a description was both inexact and incomplete. To assist in the work of comparison, there was placed in front of the lecturer a typical large microscope of the present day, with its four essential parts—the general support of the instrument, the stage on which the object is supported, the illuminating mirror, and the magnifying lenses. This typical microscope, having the three special features of stability, subservience of everything to utility, and absence of any fanciful or incomplete arrangements, certainly looked, what it was, a costly and beautiful instrument, with its manifold developments. To some, Mr. Crisp remarked, it might seem as if the glittering appearance of the instrument was intended to please the eye, but as a matter of fact there was nothing about it that was designed for ornament or to gratify æsthetic taste. When microscopes were first made, although it was reckoned an essential in the construction of a telescope to have a firm foundation, the principle was not applied to them.

The difference between the instability of the old and the substantial foundations of the new was apparent when the lecturer passed from his modern type to the ancient forms around it. The collection represented but a small proportion of the microscopes that had been described and figured, as a reference to the books placed by Mr. Crisp upon the library-table showed. Looking at these antique specimens, one could not fail to be struck with their extraordinary diversity. They were made of paper, parchment, leather, wood, and even tortoiseshell, and some of them were profusely ornamented. The most remarkable in this respect was a microscope which belonged to Pope Benedict XIV. at the end of the 17th century. The instrument is fixed to the top of a square box or cabinet, ornately decorated with the Papal insignia. Even the holder for the objects and the tube of the microscope are richly ornamented, while the inside of the cabinet and the drawer are lined with silk. A Roman ormolu microscope Mr. Crisp likened to some of our cheap upholsterer's work, upon which a piece of brass or ormolu is clapped on wherever it can be made to stick. One of the ornamented examples looked not unlike a Queen's reading lamp in general shape. The Jena tripod is a curious design with an elaboration of paint and carving, which Mr. Crisp claimed as a triumph of meretricious decoration. There were eight instruments in succession pointed out, in all of which ornamentation was the prominent feature, and one of them (a De Chaulnes) had a tube of tortoiseshell.

Judging by a scientific standard, the lecturer concluded that the æsthetic tastes of the old opticians led them far astray from their proper path. The microscopes seemed to have been built to give the least possible trouble when the time came for them to tumble down. There was a Divini, for example, which a breath of wind would blow over. The great difficulty of the "ancients" was the illumination of the object. The mirror of the modern microscope is one of its most important developments, and its adjustment one of the arts to which the early attention of the student is directed. The old microscopists, of course, knew about the laws of the reflection of light, but their microscopes were made without mirrors. A similar lack of practical genius was also displayed in focussing. The unsteady movements of an elegant ebony and ivory, and a tall wooden microscope of Italian make, were made to point the moral.

Mr. Crisp, indeed, conclusively proved that whatever the "good old times" might have been in other respects, they left much to be desired in the condition of microscope-making. At the same time, the old makers deserve all credit for what they did with their defective tools; and they never arrived at the absurd degree of specialisation characteristic of the present.

Some highly effective illustrations on the screen added to the appreciative enjoyment of the lecture, which was delivered extemporaneously, and was in parts very humorous. Altogether there were 300 of Mr. Crisp's microscopes shown in the lecture theatre, or library—to use Mr. Crisp's words, "many of them rescued from attics and dustbins all over Europe."—*Daily News.*

Short Papers and Notes.

Butterfly Collecting on the Riviera.

THE environs of Cannes, Nice, Mentone, San Remo, and, above all, Hyères, with its pine-woods and groves of arbutus, and hillsides clothed with myrtle and cistus, furnish, even in November, and again from February onwards, some of the choicest entomological treasures. An April day at Hyères well spent is an event to be ever remembered in the life of an enthusiastic naturalist. How often in after days will he recall the first sight of the flaunting orange of *Gonopteryx Cleopatra* careering over the tall Mediterranean heath (*Erica arborea*), the timid fluttering of *Euchloë Euphenoides*, between the tree stems, the local haunt of *Thestor Ballus* at the

edge of the wood, and the patch of lavender or knoll of cistus which attracts, every quarter of an hour at least, one specimen of *Thais*, replacing the last consigned to his collecting-box; then *Euchloë Belia*, with its silver and green under-wing, *Lycæna melanops*, rising out of the beaten brushwood, the breathless chase of *Argc Syllius* (Psyche), and, perchance, the fortunate capture of *Libythea celtis* or *Vanessa Egla;* not to mention a host of other beautiful insects, such as *Papilio Podalirius*, gently swooping along, and ever and anon floating on its wings, the short-lived *Euranthis plumistraria*, which may be found in abundance for about a fortnight, but of which not a specimen will be seen afterwards, *Deiopeia pulchella*, frequenting the neighbourhood of the seashore, *Thecla rubi*, the green of whose underside is scarcely distinguishable from the juniper or myrtle, on which it rests, and many common species, such as Painted Ladies, Clouded Yellows, Orange Tips, Bath Whites, and Grizzly Skippers, in plenty.

Nor can he forget the repose of the well-earned lunch, in the shade of an umbrella pine, with a view of the blue Mediterranean and the "Golden Isles" in the distance, the air fragrant with the aromatic balsam of pine, eucalyptus, and rosemary. Such days as these raise the memory like a reminiscence of paradise, fraught with glories of colour, odour, light, and life.

The botanist has no mean enjoyment in his excursions, but the entomologist has the added triumph of an exciting chase or wary approach to add zest to discovery.—*From "A Handbook of European Butterflies," by W. F. de V. Kane.*

An Expression of Animal Sympathy.

While riding along a country road in the environs of Cincinnati, Ohio, about the 1st of last October, I noticed a very amusing display of animal intelligence. In a field beneath some trees at the bottom of a very high hill stood, facing each other, a donkey and a young bull. The bull was standing very patiently, slightly nodding his head up and down, while the donkey, with a rather heavy stick about two feet long in his mouth, was scratching his companion's forehead. We stopped our horse and watched the operation for some time. Once the donkey dropped his instrument, but, without hesitation, lowered his head, picked up the club again with his teeth, and continued scratching very gravely, to the evident satisfaction of the bull. We often see two cows "rubbing horns." Whether this was a return for a similar favour from the bull or not, the donkey very clearly realised his poverty in the matter of horns, and happily supplied a deficiency.—Charles L. Edwards in *American Naturalist.*

Russian Iron.

Probably, the only secret process which has been kept inviolate, and for ages openly defied the world of science, is the iron trade of Russia. The secret of making Russian iron is owned by the government, and is such an immense monopoly that it is currently supposed to defray the entire expense of the government.

The works constitute an entire city, isolated and fortified against the rest of the world. When a workman enters the service, he bids a last farewell to his family and friends, and is practically lost to the rest of the world. He is never heard from afterwards, and whether he lives or dies all trace of him is for ever lost. There have been several desperate attempts made to steal or betray the secret, and in every instance it has resulted in the death of the would-be traitor. In one case a letter attached to a kite, which was allowed to escape, was picked up by some peasants, and despite their protestations that they were unable to read they were at once put to death by the guards to whom they delivered the letter, and it was afterwards decreed that the guards themselves should pass the remainder of their days within the works.

The wonderful properties of this iron are so well known that it is unnecessary to enlarge upon them. Imitations have been made closely resembling the original article, but the durable polish, toughness, and anti-rusting properties are lacking, and to-day the secret remains as hidden as the philosopher's stone. It has been recently claimed that a new discovery has been made, which, it is believed by some, will develop into an article equally as good, and preparations are now being made to erect large works in America for its production, but it is too early yet to predict what may be the result.

New Source of Verbena Oil.

The *Eucalyptus Staigeriana* tree, known as the lemon-scented iron bark, is a native of Queensland. Its leaves possess an odour exactly like that of the lemon-scented verbena, and the oil they yield is equal in fragrance to that of the so-called oil of verbena of commerce, which is not obtained from the verbena, but from the grass, *Andropogon citratus*. The dried leaves, according to Staiger, yield two and three-quarters per cent. of volatile oil of sp. gr. 0·901. The demand for the lemon-grass oil is considerable, nearly fourteen thousand ounces having been exported from Ceylon in 1805; it is also largely manufactured in Singapore. Hence the tree, the *Eucalyptus Staigeriana*, appears worthy the attention of planters on account of its volatile oil. The odour of the oil is quite different from that of *Eucalyptus citriodora*, which

resembles, and might be substituted for, citronelle oil, so extensively used for scenting soap.

Prof. Tyndall on the Electric Light.

An interesting lecture was recently delivered by Professor Tyndall on the above subject. Beginning with the discovery of Volta, he explained the principles of galvanic decomposition and resistance to the electric current, and stated the part which Davy took in demonstrating the importance of Volta's discovery. A fresh step was taken in 1831, when Faraday discovered magneto-electric induction. From this time the work was carried on by Holmes, the Alliance Company of Paris, M. Gramme, Dr. Siemens, and Sir C. Wheatstone (who made an important discovery simultaneously), and a number of inventors whose names had been recently before the public. [The several machines made up to late times were described, a multitude of experiments was made by the lecturer, assisted by Mr. Cottrell, and various modes of electric lighting were exhibited. Mr. De Meritens showed his electric candle of three carbons, the current being generated by one of his machines, which Professor Tyndall said he trusted would put inventors on their mettle. Mr. Ladd showed the Wallace-Farmer machine, and illustrated the brilliant effect of the incandescence of iridium. M. Rapieff showed his lamp, as now used in a newspaper office. The Jablochoff candle was also exhibited, a Siemen's lamp hung from the roof, and Mr. Werdermann's light was fitted up in an adjoining room.]

In conclusion, the lecturer said he would not then go into the questions of the division of the electric current and incandescence. All the laws of the subject he had been dealing with were known, and there was no room for a discovery in the scientific sense, but there was room for the application of such mechanical ingenuity as had given us the sewing machine, the phonograph, and many other things. The investigator and discoverer pursued his theme for the sake of gaining knowledge; the inventor's aim was generally to make money, though he gladly recognised that in many cases the inventor was stimulated by love of his art. Sometimes these men spoke disrespectfully of each other, as Cuvier despised the man of practical application, probably not taking into account that the application of science reacted on science. The amelioration of the condition of the community was, at any rate, an object worth labouring for. Still, it was well to remember that those discoveries and applications which struck the public mind and excited so much discussion, often come from men whose sole stimulus was an intellectual one. As to the philosophic aspect of the question, there was a small

cohort of social regenerators, men of high aims, and for whom he had great respect, who would hand over science and scientific men to a hierarchy which would determine the particular subjects that the scientific man ought to pursue. Where that hierarchy was to get its wisdom, they never explained. Those writers denounced and scorned all reference to what they considered to lie apart from human needs, and yet upon sensible conceptions—as of molecules, for instance—sometimes depended the greatest discoveries. When the feeble magneto-electric spark was first introduced, an Oxford don expressed his great regret that such a discovery should have been made, for, he said, it put a new and facile instrument in the hands of the incendiary! Let them imagine that hierarchy of which he had spoken watching Faraday peddling over his magnets. They would certainly have sent him back to the bookbinder's bench as a far more dignified occupation. Yet it was Faraday's spark that now shone, and which he hoped would illuminate our quays and halls, and esplanades and squares, and possibly also our homes.

The Spruce Fir.

The species is widely distributed both in latitude and longitude —more so, in fact, than many of its allies, being indigenous alike in the Kurile Islands and Siberia as in Norway, and from the Swiss Alps to beyond the Arctic Circle. Though in its extreme northern area it seldom occurs at an altitude of more than 750 feet above sea-level, in the south of Norway it reaches more than 3,000 feet, at the same time descending the shores of some of the fjords down to the water's edge. It is, in fact, the prevalent tree of the basin of the Baltic, and Loudon states that the finest spruce forests which he had seen were between Memel and Königsberg, growing in peaty soil, resting on sand, and liable to inundation during a great part of every winter. It is, in fact, owing to its requirement, for its successful cultivation as a timber-tree, of soil that in England or Scotland can be profitably cultivated for agricultural crops, that the spruce has not been so extensively planted as the Pine and the Larch, which flourish in drier and more barren soils. The wood of the spruce is generally white, more elastic, less resinous, and consequently lighter, than that of the Scotch pine. When grown in the open, where large branches may be broken off, it is apt to be very knotty; but in denser forests, where it is drawn up, it is fine and even in grain. It has been largely imported into England from Norway "in the round," for masts, spars, scaffolding, and ladders. These are, however, the smaller trees, imported with the bark on. The larger trees are sawn up, and are known as White Baltic, Norway,

Christiania, or Dantzig deal. They are much used in building, both for joists and for flooring, while of late years immense quantities have been brought over in a manufactured state as door and window frames or cheap furniture. The waste is used in Sweden for matches and for paper-pulp. The wood is durable when kept dry, as when the bark is left on, and its grain adapts it for carving, polishing, or gilding. The resin, though less abundant than that of the pines, is of considerable value. It oozes as a fine yellow turpentine, known as "spruce rosin" or "frankincense," from cracks in the bark or from artificial incisions, for as long as twenty years; but eventually the wood is rendered valueless for timber, and even almost useless for fuel. By melting, boiling with water, and filtration, the medicinal Burgundy pitch is prepared from this resin in the Vosges Mountains, besides small quantities of colophony, lamp-black, and spirits of turpentine. In Norway the bark is used for tanning, though inferior to that of the larch; and in times of scarcity the sweetish bast is even ground down with meal as a bread-stuff. The roots also in the same country are split and boiled in a ley of wood ashes and sea-salt, which so loosens the fibres that they can be twisted into cordage, with which thin planks of the wood are tied together into extremely light and portable canoes. The young shoots, too, are used as winter fodder, or are spread, with those of the juniper, as were rushes in the England of the olden time, on the floors of churches and private houses; whilst in all countries where the spruce grows, decoctions of these shoots in fermented liquor are used as a beverage or as a remedy for scurvy.—*From "Cassell's Familiar Trees"* for January.

Photographic Notes.

To Recover Gold from Old Toning-Baths.—The *Chemical News* publishes the following method for recovering gold from old toning-baths:—Sulphurous acid, in solution, is added to the dissolved gold, and the whole heated for half-an-hour; at the end of that time, the gold is all precipitated, and can be filtered off at once—a rapidity which is not permissible by the ordinary means, as any one who is familiar with the process well knows. There is also avoided all trouble in getting rid of iron, as in precipitation with iron salts.

Photographic Microscopic Stereographs.*—There are innumerable bodies in the world of small things which can only be observed, so as to realise their configuration, by a binocular microscope; and in the case of such objects, no matter how much they may be enlarged by photography in the usual way, or with what perfection their detail may be rendered, they still afford a very inadequate idea of their form.

Our object at the present is to point out briefly some methods by which the possessor of an ordinary monocular microscope may be enabled to photograph any suitable object with all the relief as seen in the finest binocular instruments, and this, too, without incurring much expenditure for costly appliances. Premising that the method to be described is intended for employment with low powers, we shall explain its principle of action by a simile we employed many years since, when we had occasion to introduce it to the notice of our readers in those days. Let a bust or statuette be placed on a table at a distance of a few feet from a single fixed camera, and a negative be taken. Now, without moving the camera, rotate the statuette on its axis in the slightest degree, and then take a second negative. Prints from these two negatives, when mounted side by side on a stereoscopic card-mount and examined in the stereoscope, show the image in all the solidity that could be desired, the amount of relief being determined by the extent to which the original object was rotated previous to the second negative being taken. Reasoning from analogy, we now proceed to apply this system to the production of micro-stereographs.

The object-slide must not be placed flat down directly on the stage of the microscope, but upon a secondary or super stage, so constructed as to allow of a small platform, upon which rests the object-slide, to oscillate from right to left within a limited sphere. The one we constructed for the purpose is made of thin brass, pivoted at its two sides into guiding side-pieces, the axis of motion being adjusted so as to coincide with the object to be photographed. Having focussed the object, and using a diaphragm in front of the objective so as to increase its penetration, the first photograph is taken when the little see-saw slide-holder is tilted to one side, after which it is tilted to the opposite side preparatory to making the second exposure. The amount to which the tilting takes place must be only very slight, else the apparent solidity of the image, when subsequently examined in the stereoscope, will be exaggerated.

Success in this is ensured by employing an objective of small

* From *The British Journal of Photography.*

angular aperture, or, should it be too wide, limiting this otherwise excellent quality by a diaphragm cap being slipped over the end.

Another way by which stereoscopic photo-micrographs can be obtained by a monocular microscope is to employ an objective having an effectively large front lens, and covering it with an easy-fitting cap, having in it an aperture so much at one side as to cover up one half of the lens. When making the first exposure, the cap is turned so as to uncover one side of the lens, and is rotated half a turn before taking the second negative. The resulting pair of pictures will be stereoscopic.

There are several other methods which may be employed, and which are more especially adapted for the higher powers. This article is, however, mainly intended for the photo-microscopic aspirant with limited appliances.

Practical Hints.

Flexible Mucilage.—To 20 parts of alcohol add 1 part of salicylic acid, 3 parts of soft soap, and 3 parts of glycerine. Shake well, and then add a mucilage made of 93 parts of gum arabic and 180 parts of water. This is said to keep well and to be thoroughly elastic.

Spores of Equisetaceæ.—An interesting microscopic amusement for this season of the year, is to gather a few heads of Equisetaceæ (horsetails), which will soon be readily obtained. If some of the spores be taken on a glass slip, placed upon the stage of the microscope, with a 1-inch objective, and gently breathed upon, the effect is magical. Each of these spores has two pairs of elastic filaments, which, when exposed to warm moisture, jump and curl in the most amusing manner, the object of this movement being the same as that of the fern antherozoids—viz. the fertilisation of the embryonal corpuscle.

Good Polariscope Object.—A section of oak bark, carefully cut in a direction parallel with the outer surface, and down the tree, mounted in balsam after prolonged soaking in turpentine, forms a very lovely polariscope object, with an inch objective, and no selenite. Long linear series of cells, each containing a crystalline body, are seen as many-coloured lines of stars, when the Nicol's prisms are crossed.

Oil of Anise.—This oil freezes at 50° F., it then makes a most beautiful polariscope object. Thaw the oil, place a drop on a glass slide and allow it to freeze, which it soon does, then view it under a thin glass cover without a selenite. As soon as the oil begins to melt again, lovely forms of the brightest and most varied colours will be seen in motion in the field, their colours ever changing as their position changes with respect to the plane of primitive polarisation.

Cheap Paint.—By mixing very fine coal with linseed oil, you can make a paint, the application of which to posts before letting them into the earth will preserve them for centuries.

A good Polish for Furniture.—To polish furniture and preserve it, a most simple and effectual method is to mix equal quantities of vinegar and sweet oil. Well wash the wood with warm water and soft soap, and dry it thoroughly ; then apply the polish with a piece of flannel, and let it remain on a short time, so that the vinegar may sink into any little cracks there may be, and kill the insects which frequently hide there, especially if the furniture is old. Afterwards, rub with a clean soft cloth.

Answers to Queries.

318.—Fish-Skin and Scales.—For the polariscope these should be mounted in balsam, but for ordinary purposes it is best to mount them in a simple dry cell as opaque objects, as when mounted in fluid or balsam they become so very transparent that their structure is rendered almost invisible. A ring of varnish makes a sufficiently deep cell in most cases, as a little pressure only prevents them from curling up. For the skins a deeper cell may be fixed, such as a ring of thin cardboard. I would also suggest the use of the tiniest atom of gum tragacanth dissolved in water to form a paste, by means of which the scales may be held to the slide, and prevented from slipping ; a good background may be produced by a patch of asphalt on the under-side of the slide. If balsam is used, the scales may be arranged in a group in a small drop of balsam on the cover, the latter exposed in a warm place (protected from dust), till the balsam is hard, and then turned over into a fresh drop of balsam, on a clean slip, without displacing the scales ; they may, however, slip slightly out of place in the subsequent drying, if the slide be not kept horizontal. The prevalent craze for staining has not spared even fish scales, though

loading them with dye has no other effect than to take away their natural appearance. G. H. B.

321.—Arranged Diatoms.—In the *Enquirer* for March, 1887, I gave an account of my method of mounting these, which has proved very successful. I think it will be found satisfactory. The cement used is a solution of white shellac in alcohol. G. H. B.

323.—Barbados Earth.—I believe the method described in "Davies on Mounting," is still very generally used. To disintegrate the earth he gives the following plan :—"Take 3 oz. of the earth (lumps are best), and break into rather small fragments, put 3 or 4 ozs. of common washing soda into a tin saucepan holding one pint, and half fill it with water. Boil strongly, and having thrown in the earth boil it for half-an-hour. Pour nine-tenths of this into a large glass vessel, containing 3 or 4 quarts of water, and gently crush the remaining lumps with a soft brush, add soda and water as before, and boil again, then pour off the liquid into the large vessel and repeat until nothing of value remains. Stir the large vessel with an ivory spatula, let it stand for three minutes, and pour gently off nine-tenths of the contents, when the shells will be left partially freed, only like sand." The boiling process may then be continued. G. H. B.

325.—Weight of the Earth.—To measure the earth's mass, in terms of a known unit of mass, such as a pound, it is necessary to compare the attraction of gravitation exerted by the earth on a given body, with that exerted by a heavy sphere whose mass is known in pounds, acting on the same body, when the latter is placed at a known distance from its centre. Then, since the attractions of spheres vary directly as their masses, and inversely as the square of the distance from their centres, it is only necessary to know the radius of the earth, in order to complete the determination both of its mass and density.

To measure the attraction between the two known masses is, however, a matter of considerable difficulty, owing to its smallness, and the best way of doing this is that known as the "Cavendish Experiment," in which this is done by means of a sort of tortion balance. Two equal balls are attached to a light horizontal beam suspended by a thin wire, and two heavy spheres are brought near the balls in such a way as to turn the rod about the wire, till the attraction of the spheres is balanced by the elasticity of the wire. The angle through which the beam turns is then measured, and the elasticity of the wire is supposed known. By this means the attraction of the spheres are determined. There are many modifications of this method required in practice, but they are of

a very technical character. There are other methods of weighing the earth, such as by measuring the attraction of a mountain, or the difference between the period of oscillation of a pendulum, at the top and bottom of a mine, but these are very uncertain, as they require us to know the exact density of the earth in the neighbourhood of the scene of experiment. G. H. Bryan, B.A.

325.—**Weight of the Earth.**—This question was recently answered in the *Scientific American* as follows:—The density, mass, or weight of tbe earth was found by the observed force of attraction of a known mass of lead or iron for another mass; or of a mountain by the deflection of a tortion thread or plumb-line. In this manner the mean density of the earth has been found to be from 4·71 to 6·56 times the weight of water, 5·66 being accredited the most reliable. The weight of a cubic foot of water being known, and the contents of the earth being computed in cubic feet, we have but to multiply the number of cubic feet by 5·66 times the weight of one cubic foot of water to obtain the weight of the earth in pounds, or units of gravity at its surface, which is the unit chiefly used. Another mode of determining the mean density of the earth is founded on the change of the intensity of gravity in descending deep mines. C.

329.—**Tracing-Paper.**—Your correspondent will find it cheaper to buy tracing-paper than to make it. It may be made as follows:—5 ounces of pale shellac, heat it nearly to the boiling-point with 1 ounce of borax in a pint of water until completely dissolved. As the water evaporates, hot water should be added to keep the quantity constant. Strain the solution, pour it into a flat dish, and draw the paper through it, then hang it up to dry. Any firm, smooth, well-sized paper may be used, and to give perfect satisfaction the paper should be calendered after drying. C.

329.—**Tracing-Paper.**—Drawing-paper may be made transparent for the purpose of making tracings, and afterwards the transparency may be removed in the following manner:—Dissolve a given quantity of castor-oil in one, two, or three volumes of absolute alcohol, according to the thickness of the paper, and apply it by means of a sponge. The alcohol evaporates in a few minutes, and the tracing-paper is dry and ready for immediate use. The drawing or tracing can be made either with lead pencil or with Indian ink, and the oil removed from the paper by immersing it in absolute alcohol, thus restoring its original opacity. The alcohol employed in removing the oil is, of course, preserved for diluting the oil used in preparing the next sheet. T.B.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply. All answers should reach us before the 12th of the month.

335.—Double-pointed Entomological Pins.—In C. G. Calwer's "Käserbuch," a method is recommended of setting Coleoptera on the top of double-pointed pins (Zweispitzige nadel), the points of which are sharp and tapering. Small beetles are empaled on the very tip of the pin, while in the case of the larger species a greater length of point goes into the insect, and thus only one size of pin is required. Even small species, such as the Cryptophagi, can be thus pinned, and the method has this superiority over sticking on card with gum-tragacanth: that the card is apt to turn brown or curl up in course of time. But Calwer gives no information as to where these pins may be obtained. Can any reader of the *Enquirer* inform me on this point? G. H. B.

336.—Multiplied Images in Eye of Beetle.—Will some of our readers tell me how to place an object that I may see it multiplied in the eye of a beetle under the microscope? W. T.

337.—Etching on Glass.—How are ornamental designs etched or embossed on glass? A.

338.—Soap-Bubbles.—I have read or heard of soap-bubbles which will last for several hours in the open air, but cannot turn up a reference to them anywhere. Will some friend help me? D.

339.—Why Flowers turn White.—Could any of your readers explain the reason of some flowers turning white, such as the foxglove, when brought into a garden? M. F.

340.—Blue Flame produced by Salt.—If common salt is sprinkled over glowing coals, it produces a purple or bluish, not yellow, flame. What is the reason of this? Is it due to absorption of the yellow rays given out by the coals owing to the sodium vapour being at a lower temperature than they are?

G. F. C. Searle, B.A.

341.—Hoar Frost.—Why is it that the hoar frost deposited on the windows in cold weather sometimes arranges itself in beautiful geometrical crystals, while at others the crystals are so small as to form merely a dull white covering on the surface of the glass?

E. Fiddes.

342.—Chill at Sunrise.—What is the reason that at sunrise the air seems so frequently to turn suddenly colder and remain so till the sun's warmth begins to be felt? E. Fiddes.

343.—To Destroy Beetles.—Can any of your readers inform me the best plan of getting rid of the *Otiorhynchus sulcatus* (or *picipes*), which does great damage to raspberry bushes?
W. R., Penzance.

344.—How to Restore Photographs.—Having among my collection of microscopic objects some badly-mounted micro-photographs, I shall be glad to know if they can be remounted without injuring the photographs. If this is possible, perhaps some of your readers may know and will kindly describe the process by which this may be done. W. H. H.

345.—Parasites on Hedgehogs.—Have hedgehogs parasites, and, if any, have they ever fleas, and have they any means of ridding themselves of them? I have a hedgehog, and a friend of mine tells me they have fleas. I have never noticed it, and rather doubt the probability of Nature having allowed an animal of that peculiar growth to be afflicted in such manner. S. B.

346.—Flies and Pedestrians.—Can any of your contributors suggest a remedy against being followed, for miles I may say, by a troop of flies, which, taking advantage of the warm summer atmosphere, attach themselves more particularly to the head of the pedestrian, and cause much annoyance by settling upon the face, neck, ears, etc.? W. W. J.

347.—Removing Shells from Brood.—Can any of your readers inform me how most birds so effectually remove the shells of their eggs when their brood is hatched, and what they do with them?
J. M. W.

348.—Combustion.—If we imagine a lamp whose wick is of considerable length, so that the flame is at a height, say, of a few feet above the surface of the oil, the liquid rising by capillary force, energy must somewhere be expended in order to lift the oil up to this height, and this can only be done at the expense of the heat given out by combustion. Therefore, the amount of heat given out when, say, a gallon of oil is burnt in such a lamp must be less than that given out if the same quantity is burnt in a lamp in which the flame is but little above the surface of the oil. The difference may be small, but it must exist. Can any reader inform me in what respect the phenomena of combustion differ in the two cases, in such a way as to account for this difference? I should be especially glad of references to writings on the subject.
G. H. Bryan.

349.—Lissajou's Curves.—Will some correspondent kindly inform us of the method pursued in forming these curves upon glass, giving at the same time a full description, with dimensions of the apparatus needful for producing them upon the usual microscopic slips, 3″ and 1″? E. B.

Exchanges.

"Cambridge Antiquarian Proceedings," 1879 to date, cost price, 44s. 6d.; also, occasional publications. Exchange for Text-books on the Microscope, Entomological or Botanical Books, or Standard Works on Higher Mathematics or Natural Philosophy.—G. H. Bryan, Thornlea, Chaucer Road, Cambridge.

British Association Handbook of Manchester, with Natural History, etc., of district and Description of Excursions. Exchange for any back numbers of *Journal of Microscopy* except Nos. 6 and 17, or for offers in books or journals. —G. H. Bryan, Thornlea, Chaucer Road, Cambridge.

A few mounts of Chalk Washings from Cambridgeshire for exchange.—G. H. Bryan.

Dragon Flies.—Mr. W. Harcourt Bath, Ladywood, Birmingham, desires to correspond with students of the *Odonata* in all parts of the globe, as he is specially working up this group of insects. Specimens for figuring in his forthcoming "Monograph of British Dragon Flies" will be very acceptable. There is probably no class of insects so neglected as Dragon flies, and Mr. W. Harcourt Bath will be very pleased to assist anyone desirous of commencing their study.

Wanted, Parasites, unmounted, prepared. Will give Slides (Anatomical, Pathological, Botanical, Micro-fungi, Parasites, Zoophytes, etc.) in exchange. Splendid Slide of Bacilli in section of Lung (acute miliary tuberculosus). Home and foreign correspondents wanted to exchange slides or micro material of above or other subjects.—Fred. Lee-Carter, Gosforth, Newcastle-on-Tyne.

The following well-mounted and neatly finished Micro Slides for exchange: —Cystolitus of *Cactus;* Cuticle of *Cactus*, in C.B.; Cuticle of *Anasassa sativa*, showing large stomata, in C.B.; Scale of the *Sudak*, a Russian fish; Pollen of *Salvia patens*, in C.B.; Section of *Dammar Wood*, in C.B.; Skin of *Sturgeon*, with bony plates *in situ*. Approval to be mutual.—Rev. H. W. Lett, M.A., Aghaderg Glebe, Loughbrickland, Co. Down.

Reviews.

Marvels of Earth, Air, and Water. Crown 8vo, pp. 129.

Marvels of the Elements. Crown 8vo, pp. 182.

Marvels of Invention and Scientific Puzzles. Crown 8vo, pp. 196.

Marvels of Heat, Light, and Sound. Crown 8vo, pp. 196.

(London: Ward and Lock.) Price 1s. each.

These are four little books, uniformly bound, of the "Scientific Recreation Series." The first gives a popular account of the Forces of Nature, Gravity, the Barometer, Air-Pump, and other curious and interesting apparatus; the second treats of the Metals, Bases, Salts, Alchemy, Distillation, Flame, and Acids; the third gives a popular account of many useful and interesting Inventions and Discoveries, treating of Chance, Magic Squares, Solitaire, the Gyroscope, Scientific Objects for the Household, Useful Inventions, New Locomotive Appliances, and many other things; whilst the fourth describes in a popular manner Heat in its various manifestations, the Thermo-

meter, Specific and Latent Heat, the Eye and Optical Illusions, the Telescope and Microscope, the Ear and Hearing, the Phonograph and Microphone, Singing Frames, etc. They form a most interesting series of books and are very nicely illustrated.

FLOWER-LAND: An Introduction to Botany for Children and for use of Parents and Teachers. By Robert Fisher, M.A. Post 8vo, pp. 62. (Manchester and London: John Heywood. 1887.)

This book, written especially for children, describes in plain language the various parts of a plant, the way in which they are arranged and named, and the uses of plants, and concludes with a short chapter on collecting and drying plants. It is written in a pleasing and easy style.

PRACTICAL GUIDE TO PHOTOGRAPHY and Photo-Mechanical Printing Processes. By W. K. Burton. Crown 8vo, pp. 355. (London: Marion and Co., Soho Square. 1887.) Price 4s.

The author of the book before us, whose works are so well known, tells us that his object is to give practical instructions in the working of all the processes which are in actual every-day use up to the present date, and to make such instructions of so full a nature that they may serve as a guide to anyone who may wish to practice the processes.

We have Historical Sketches of Photographic and Photo-Mechanical Printing Processes, followed by remarks on Contact Printing, several chapters on Silver Printing, Carbon, and Platinotype Processes, Mounting Prints, Photo-Mechanical Printing, etc.

MARION'S PRACTICAL GUIDE TO PHOTOGRAPHY. Crown 8vo, pp. viii.—229. (London: Marion and Co. 1887.)

This is a new and enlarged edition of a work which is well known to most of those who take an interest in the subject. After tracing in the first two chapters the history of the art, it treats of the application of modern photography, and careful instructions are given as to the requirements of the dark-room, exposure, development, defects and remedies, toning, fixing, mounting, etc. Several chapters are given to Portraiture and others to Photographic Optics.

THE ART OF RETOUCHING NEGATIVES and Finishing and Colouring Photographs. By Robert Johnson. 8vo, pp. 87. (London: Marion and Co. 1886.)

Very clear instructions are given here on the art of Retouching Negatives, which, if carefully and intelligently followed, will soon help the student to become very proficient in the art. Instructions in the various sections of this book are illustrated by a number of lithographic plates.

The three books just noticed are well printed and neatly bound in red cloth, and form quite a library of photographic instruction.

DAS A B C der Modernen Photographie. Von W. K. Burton. Deutsch von Hermann Schnause. Post 8vo, pp. 170. (Dusseldorf: Ed. Liesegang. 1887.)

This is the third German edition of Mr. W. K. Burton's well-known A B C, which has been very ably translated by H. Schnause.

WEBB'S (Wordsley, Staffordshire) SPRING CATALOGUE for 1888 contains, in addition to a long list of seeds and plants of every description, some very interesting Historical Notes on Vegetables, and also Notes on the Cultivation of Vegetables and Flowers.

The Scientific Enquirer.

APRIL, 1888.

The Round of Life.

WHAT I shall say on the above subject will not possess the merit of novelty to students of science, especially not to botanists, for the facts have been frequently given in better words than I can employ. But nearly all that has been heretofore written relative to the matter, is only to be found in scientific books or periodicals not conveniently accessible to the general reader; hence a few brief reflections on the subject cannot be amiss, and may arouse interest concerning some of the by-ways that lead into the great thoroughfare of Life and Thought.

All terrestrial phenomena may be classed under two grand divisions: the organic and inorganic. To the first of these belong all manifestations of nature which show the presence of life, or vital force, and the capability of self-movement. To the second belong those manifestations which evidence the absence of life and self-movement. The organic world could not exist without antecedent life—that is, each living individual, whether plant or animal, must have descended from a similar, prior individual; but the inorganic world is the result of chemical and mechanical processes, and its combinations are fortuitous. The organic world is again divided into two kingdoms, one of which has been called the Vegetable, the other the Animal kingdom. In the higher forms of life it is an easy matter to draw a line between them; but as we descend to the lower forms it becomes very difficult to distinguish between the two kingdoms. This is especially the case with those forms which cannot be perceived by the unaided vision and which must be examined by the aid of a microscope. But though the distinction between these different phases of organic life, in their external relations, is sometimes difficult to make out, it is really definite and certain, and can be readily resolved if the habits and characteristics of the doubtful organism can be determined. The grand and most obvious distinction lies

in the fact that all vegetables, except some families of parasitic plants, and, perhaps, some species described as carnivorous plants, feed alone on inorganic matter, while animals derive their sustenance from organised matter.

From this fact the inference seems inevitable that vegetable life must have preceded animal life, for without vegetable food all animal organisms would quickly and utterly perish. While animals and plants differ so widely in their mode of life—that is, in the food they consume—as well as in their organisation and locomotive powers, they yet approach each other very closely in several essential points, and in their genesis are really identical. Actual life, or vitality, is the same in both animals and vegetables; the only difference being the structure of the house it dwells in. All plants possess, in some measure, the power of self-movement. Even the most quiescent move as absolutely as the sensitive plant, Venus fly-trap, or the stamens of the barberry; though their motion is not so rapid, and consequently not so apparent to ordinary observation. Whole families of microscopic aquatic plants move from place to place freely, with a spontaneous motion equalling that of some of the lower orders of animals.

Plants, like animals, have their hours of sleep and rest. In the higher order of plants the young are developed in ovaries contained in the seed. Provision is also made in the parent plant for the support of its offspring, and in sufficient quantities to last until the young plant becomes vigorous enough to draw its own sustenance from the elements. It is indeed from this provision of vegetables for their offspring that animals derive a large portion of their nourishment; without it many could not exist. This stored food is to be found in all kinds of seeds as well as in the roots and tubers of plants and their succulent stems.

But it is in actual life, or vital force, that all distinction between animals and plants are lost. In this respect the young lady and the rose that adorns her bosom are the same, and the like is true of the ox and the plant it feeds upon. In the simplest water plants of the sea-weed family the structure of the seed is at first a very minute rounded mass. When one of these globules escapes from the mother plant it often swims about freely in the water in various directions with a truly spontaneous motion; and at this time it so closely resembles an animal organism that it is frequently mistaken for one. After enjoying this active life for several hours, it comes to rest, forms a covering of cellulose, and thereafter becomes a true vegetable cell, fixes itself to some support, germinates, and grows into the perfect plant. Each living plant-cell carries on a circulation of its own. This may be seen in the transparent stems of Chara and many other water plants, and in the leaves of the fresh-water Tape-grass. Here the fluid

circulates in a steady stream, just beneath the wall, around each cell; passing up one side, across the end, down the other, and so round, to complete the circuit: carrying with it small particles, or the larger green grains, which make the current more visible. This circulation may also be seen in hairs of plants, particularly those of flowers,—such as the jointed hairs of Spiderwort, and the hairs of the nettle, looking like strings of beads, each bead being a cell. The substance which shows independent movement in the cells and hairs of plants and the little rounded mass of sea-weed is *protoplasm*. This constitutes life, or the physical basis of life. It is present in the circulatory system of animals as well as plants, and is in every respect characterised in the same way in both. But these particles are so very minute that to see them distinctly requires a magnifying power of six or eight hundred diameters. Every plant proceeds from a single extremely minute vesicle, or cell. Growth takes place through this vesicle, or cell, dividing by the partition of a cross partition into two such cells, cohering together; one of these into two more; and these repeating the process by partitions made in both directions, forming a cluster, or mass of cells essentially like the first, and all proceeding from it. So the plant is an aggregation of countless millions of little vesicles, or cells, essentially like the cell it began with in the formation of the embryo; and this first cell is the foundation of the whole structure, or the ancestor of all the rest.

Now, it is impossible that this little vesicle, or cell, which is but a very small fraction of a grain in weight, and so little as to require high magnifying powers to be seen, could increase itself into a large tree containing innumerable millions of living cells equal to itself, the whole many tons in weight, without the existence of vital force or actual life. To do this the little cell, and those proceeding from it, by some law unknown to us, have the power of converting inorganic, or dead matter into organic, or living matter—that is, of feeding upon and assimilating inorganic substances. It is, therefore, evident, that life is drawn from and built up of non-life. We, however, only know life as associating with or following preceding life; yet, we do know that it is built up of the elements composing non-life, or inorganic things; that is, matter is taken up, and from a state of death and inactivity is changed to a state of life and activity.

Plants are built up of carbon, hydrogen, and oxygen, with a small proportion of ammonia, and from two to ten per cent of other inorganic matter. We know the chemical composition of plants, but by bringing these elements together, we cannot produce life. As well might we expect a temple adorned with architectural beauty to spring into existence from throwing the raw material together, as to expect life to develop from bringing the elements

together, that plants build themselves with. By some hidden law an almost infinitesimally small germ of life has the power of converting inactive matter into active living matter, to form plants. These, in turn, compose the food of animals, and are assimilated by them to form another complication of life—*i.e.*, animal life. If the plant is burned, or suffers natural decay after death, it returns to its original elements and in precisely the same proportions as drawn from the earth and air; or, if the plant is devoured by an animal, precisely the same occurs at the death and decay of the animal. A little living germ, in some incomprehensible way, causes inactive matter to become active for a little season. It first manifests life and activity in the plant, then in the further complication of animal life, and at the death and decay of the plant or animal becomes dead matter again. Here is the whole round of physical life. It is drawn from dead matter, and, after a short interval of activity, returns to dead matter again. Is the germ, too, made active by some force inherent in matter? It sometimes remains inactive in the seed for many years, and then springs into life. But then it may be said to inhere in the seed, and so it is. We have no right, however, to assume that conditions have never been such as to produce the germ itself from dead matter, or that such conditions do not now exist, or that they may not exist in the future.

The Axolotl.

THE transformations in case of the amphibia from the larval to the very different adult form have furnished common and interesting cases of metamorphoses, which all have witnessed. Perhaps the most curious representative of this group of animals is the axolotl, which inhabits the high plateaus of the Rocky Mountain region, from Montana to Mexico. The animal is ten or twelve inches long, fish-like in form, but with four legs, a long tail like that of a salamander, and a tuft of gills on each side of the large, flattish head. Specimens were taken to Europe many years ago. At the Jardin des Plantes one of these animals left the water of the aquarium in which it was kept. It had lost its gills, but they were replaced by lungs. An experiment was then made on specimens kept by Freulien Marie von Chauvin. She removed them from the water, kept them in damp moss, and thus actually forced them to transform into the gill-less, air-breathing state. They then somewhat resembled the large yellow-spotted salamander (*Amblystoma*), so common in this region. Previously it was supposed

that the larval or gill-bearing stage was the permanent one, especially since in it they breed—lay eggs which hatch into similar forms, as is the case in permanently gill-bearing species. The adult is not so large as the larval form, giving us, as Packard has said, an epitome of what has happened in the life of this and other classes of animals. For the fossil forms were monsters, yet larval and premature as compared with their descendants. Extended experiments have been more recently made upon these animals by the same lady. She found that younger specimens could be more easily forced to transform than older specimens. If the water in which they are kept contains but little oxygen, so that they must come frequently to the surface for air, they transform more readily than if the water is thoroughly aerated. Freulien von Chauvin then tried the experiment of converting the axolotl back from the higher stage to the lower. In this she succeeded, or at least a vigorous larval animal fifteen months old, after being transformed to the adult stage (which required twelve days), and being kept out of water for another fifteen months, was brought back again to the water, to which element it accommodated itself in the course of six days. Here it lived three and one-half months. Then it was again forced to live on land, which it did six months—till the time of its death.

Some animals were kept in a state of suspended metamorphosis for three years; that is, when partially transformed, further change was prevented by low temperature and being placed at night in the water. Then some of these partially transformed specimens were forced to return to the larval stage (axolotl), and the others to the higher stage (amblystoma). It was believed for a long while that the axolotl in its native regions never transformed to the amblystoma stage; but it has been proved that, while many do not, certainly others do. The latest observations were published in *Science*, July, 1885. Dr. Shufeldt, located in the northwest part of New Mexico, has kept the animals in aquaria, studying their habits and propensities. He has also had opportunity to watch them wholly undisturbed in their native ponds. He corroborates the several statements made by Freulien von Chauvin. He finds also that they are very voracious animals, and that if fed abundantly with meat, the amblystoma, or adult animal, is much larger. The deeper the water in which they are placed, the less likely they are to transform; but in shallow ponds that have little or no vegetation, where the bottom is formed of hard clay, the larval form is longer retained, and the colour of the animal, though usually quite dark, becomes, in this case, very light. During the past summer, Dr. Shufeldt saw the ponds where were multitudes of these animals rapidly dry up. Those caught by the disappearance of the water in their quarter, disap-

peared in the mud, and, just beneath the surface, very quickly transformed to the lung-bearing stage, and left for adjacent woods. Others in deeper water remained undisturbed. If a rain came suddenly, refilling the dry pond, the further change of the half-transformed axolotls at once ceased, and they continued to live in the water as before. But subsequent drying would compel them to take on the adult, or amblystoma stage.—*Prof. Kellerman, in Industrialist.*

Short Papers and Notes.

A Vegetable Compass.

AMONG the wonders of the "Wild West" that have recently been discovered is a vegetable compass. The American Association for the Advancement of Science publishes in its *Transactions* a report penned by General Abford, of the United States army, and treating of an extraordinary plant growing wild in the States of Oregon and Texas, the leaves of which point due north and south, and are consequently utilised by belated prairie-hunters as convenient substitutes for the magnetic needle. Professor Gray Meehan, who has examined specimens of this gifted shrub at the request of the Association, defines it as a dwarf variety of the osier, named *Sylphium Laciniatum.* It is a perennial, and attains a maximum height of 3 feet 6 inches. The peculiar propensity of its foliage is attributed to the fact that both surfaces of its leaves display an equal receptivity for light. All the other known varieties of the *Sylphium* class are characterised by the presence on the lower surface of their leaves of from twice to thrice as many respiratory vessels as are contained in the upper surface, which is therefore the more sensitive to light influences of the two. But both surfaces of the *Laciniatum* are clothed alike with an epidermis exceptionally receptive of light; and, according to Professor Meehan, the same instinct of its leaves that prompts them to require an equal distribution of light upon their either surface, causes them to assume a vertical position, and to point due north and south—one flat of each leaf thus facing the east and the other the west.

Destruction of the Phylloxera.

Dr. Clemm has patented the following process in most civilised countries. He incorporates with the soil sulphides and carbonates, which easily undergo decomposition, preferably those

of potassium. Peat which has been made to absorb sulphuric, nitric, or phosphoric acid, is then also introduced. The acid gradually acts upon the sulphide and the carbonate, liberating sulphureted hydrogen and carbonic acid in the soil. These two gases, according to the experiments of Dr. Eyrich, of Mannheim, are rapidly and uniformly distributed, and prove fatal to the *Phylloxera* or grape-vine parasite in its underground stage, as well as to Colorado beetles, field mice, moles, etc. The potash remains in the soil as a sulphate, nitrate, or phosphate. The question is whether useful animals, such as earthworms, humble bees, carnivorous ground beetles, etc., will not be destroyed also.

Lightning and Barns.

A writer in the Farmers' *Home Journal* says that lightning is simply a powerful electric spark caused by a current of electricity passing from a positively charged cloud to one that is negatively charged. Electricity follows the shortest and most favourable course of a good conductor. Water is one of the best conducting substances, and a stream or body of heated, moist air affords an easy course for the passage of electricity from the clouds to the earth. A barn filled with new hay or grain gives off a considerable quantity of moist, heated air, which, rising, forms a column often several hundred feet high. This leads the lightning into the barn, which, of course, it sets on fire. Barns with ventilating cupolas are most often thus burned, by reason of this moist current of air ascending in a compact stream. When the ventilation is through several openings, of course there is less risk. A lightning-rod under such circumstances is not capable of conducting an electric discharge from the clouds to the ground, and hence is no protection, its only efficiency as a safeguard being in conducting in one *uninterrupted*, quiet stream the electric current to the ground. Sometimes, it is true, a current of warm, moist air, such as in the above case, will conduct the electricity safely to the ground, provided nothing should intervene to divert its course, but if a break should occur a flash is thus produced, and fire the consequence. Stacks of hay for this reason are not so often burned as barns. Trees when in foliage continually give off moisture through the leaves, and, as a consequence, are often struck, while dry, dead leaves as often escape.

Fluatation.

Fluatation is the name applied by Messrs. Faure, Kessler, and Co., to a new process of hardening building stones through the application of hydrofluosilicates. The operation is very simple, and can be performed whenever desired, either upon the stone before it is put in place, or after the building or other structure is

completed. The surface of the stone is covered to the desired degree with a solution of the fluate by means of a brush, sponge, or hand-pump. Another application is made the next day, and a third one the day after. As a general rule, it requires three applications. The hardening takes place at once, and upon the third application becomes perfect. There are several soluble fluates, each of them having its peculiar properties. One darkens the colour of the stone, another whitens it, another preserves the original colour, and others colour the stone indelibly. The colouring fluates mostly employed are those of iron, which give a brown tint, and those of chromium and copper, which give two greens of different shades. Fluatation is applied to old structures as well as to new ones, and is a true means of preserving the edifices that have been bequeathed to us. After the stone has once been fluated, it becomes so hard that it can be treated like marbles and porphyries. Upon applying the coloured fluates along with a subsequent polishing, very remarkable decorative effects are obtained, inasmuch as the intimate structure of the stone is brought to light, and the nodules, veins, and fossils are delineated in different tints. After the stone has been fluated, it can easily be rendered impermeable, and, as it is not attackable by ordinary liquids, it may be used for making tables, sinks, baths, and reservoirs for a host of liquids, such as wine, oils, alcohols, molasses, etc. Fluatation is applied in the same way to cement, mortars, stuccoes, etc., provided they are more or less calcareous. It renders the alkalies of cements insoluble, and thus, after a washing with water to remove the excess of fluate, permits of a coating of paint being applied.—*La Genie Civil.*

Collecting Microscopic Algæ.

Take waxed paper (from cakes of soap, etc.), and punch holes slightly smaller than the largest covers, then wrap the paper about the slides in such a way as to bring the holes in the middle on each slide. On suspending the slides, good mounts can be obtained. Surround it with a ring, place on another slip or cover-glass, and it is ready for observation.

Snout-Moths.

These insects fly near the ground, and suddenly settle and disappear as if by magic. Their wings are broad and ample in proportion to their size ; but when they are folded, the moth looks so much like a large grass seed that it mostly escapes detection.

Herald-Moth (*Scoliopteryx libatrix*).

This beautiful insect occurs in great profusion in some of the

southern parts of England, but is very rare in the north. It is called the "herald" moth, because it is said to indicate the approach of winter.

Preparing Sections of Buds.

Take a small piece of a twig—say, linden—having a bud at its upper end; fix well in section cutter, wet with alcohol, cut with a sharp knife into thin slices, keep flooding the knife with strong alcohol to keep the sections floating, and to keep them from falling apart. Do not let a drop of water touch the section, or it will cause it to fall to pieces. Now place in alcohol, faintly coloured with iodine green; let them remain in for several hours until the colour disappears from the alcohol. Again put them into alcohol, this time coloured a little more deeply with eosin in place of green. Let them remain there till they are all pink. Then wash in two alcohols of 95 per cent., drop into clove oil for a few moments only, and mount in Canada balsam. They are thus very instructive.—V. A. Latham, F.R.M.S.

The Nervous System in Sponges.

This may be demonstrated by (1) osmic acid until the sponge is dark brown, then wash and place in 33 per cent. of alcohol, then in picro-carmine; (2) absolute alcohol, wash, then stain with alum carmine; (3) corrosive sublimate solution, 40 per cent., followed by hæmatoxylin. The sections must be cut very thin. In the Sycones they form a ring in the walls of the pores, and are distributed in bunches irregularly over the surface of the leucones. The sensory nerves are long and fusiform, and arranged at right angles to the surface. They are also said to be mesodermal, and do not appear as modifications of the ectoderm, a conclusion which differs with the sensory element in other groups.

Answers to Queries.

317.—Styrax,—Mr. A. C. Cole thinks styrax is a *perfect* substitute for balsam and is easier to work with. It will probably be found that diatoms mounted in gum styrax or storax are less liable to accidents than balsam mounts, as the latter become resinous in time, and the covers are liable to spring, the result of which is the appearance of prismatic colours in the balsam. I believe styrax may be regarded as absolutely permanent and unalterable. Purified styrax contains a granular substance, which must be removed by dissolving it in chloroform and filtering the

solution; use no Canada balsam. Air-bubbles are not produced on applying heat. The crude styrax, as purchased, should be exposed in a thin layer to the sun for several weeks. The yellow colour is thus got rid of as well as the water, and it becomes hard. Dissolve in chloroform as above, or, instead, benzine, or a mixture of benzine and absolute alcohol may be employed in making the solution, while a solution of ether will prove valuable when rapid "setting" of the medium is desired. In my opinion, it shows the finer parts of objects more clearly. Cartilage, when properly stained, shows much better than when mounted in glycerine jelly. For histological work, I think it an improvement on Canada balsam, etc. Tooth, bone, and other sections show better. In botanical specimens it is very good, and it shows aleurone grains in sections of castor-oil plant very finely; also, mycelia of fungi show more clearly. Its refractive index is higher than balsam—1·585—and is less brittle. This gives for diatoms a marked increase of visibility over Canada balsam, as if we take the index of diatomaceous silex to be 1·43, balsam gives a visibility of 9 and styrax more than 15 (Allen and Hanbury's analysis). It appears to keep well. Mr. J. Deby prefers the old balsam mount as the safest.

V. A. Latham, F.R.M.S.

318.—Fish-Scales.—For the polariscope balsam is generally used, otherwise dry-mounting is preferable. See *Scientific Enquirer*, Vol. I., pp. 73—91. V. A. L.

319.—Teeth and Bone.—Try mounting in styrax or nearly hard Canada balsam. I think J. E. Ady's *laccic-occlusion* method will be found good. See *Scientific Enquirer*, p. 197, Vol. II., and *Science Gossip* on balsam mounting. V. A. Latham.

320.—Arranged Diatoms.—This or a similar question was asked in Vol. II., but has not been answered. Perhaps the enquirer will find the following useful, I having found it so:—Febiger's size, made with acetic acid, 12 drms.; photographer's gelatine, 2 drms.; alcohol, 1 drm. Use a porcelain dish, add acid to gelatine, and stir in a water bath until dissolved; then add the alcohol and filter. Spread on slide with a fine needle.

V. A. Latham.

320.—To Arrange Diatoms.—I would caution any inexperienced microscopist against wasting time in doing what V. A. Latham recommends at p. 36. Diatoms are so minute that, no matter how finely "gum" may be powdered, it will look like sand beside them, and the breath is not sufficient to dissolve any gum when in powder on a slide, so as to leave that perfectly even and imperceptibly thin film which would fasten the diatoms when arranged. Evidently V. A. Latham has heard of breathing on a

slide when the frustules have been got into the desired positions; but the slide must previously be prepared with a wash of very weak gum tragacanth, or gum acacia, or water, or isinglass and water, and allowed to become almost dry before arranging the diatoms, either singly or in patterns, on the centre of the slide. And then the breath is just sufficient to moisten the very thin layer of adhesive matter and fix the diatoms, so that when the benzole, etc., is applied they will not float away. Another plan is to use some few drops of the gum-water in the last washing of the diatoms. I recommend your readers to refer to Vol. III. of the *Journal of Microscopy*, pp. 138, 229, and Davies "On Mounting Microscopic Objects." H. W. Lett, M.A.

321.—Cleaning Diatoms.—For large forms, boil in pure soap; let the diatoms settle, and then pour off the soap and water. But for small forms I use aqua ammoniæ. L.

322.—Bleaching Diatoms.—Try by burning (deflagrate) with potassium nitrate (saltpetre) in small quantities at a time. Sulphate of potassium and pure diatoms will be left. The sulphate can easily be washed away by the use of plenty of water. V. A. L.

323.—Barbadoes Earth.—I find a saturated solution of citric acid acts on the iron more promptly than the mineral acids.

V. A. L.

323.—Cleaning and Mounting Polycistina.—The "earth" should be broken into small pieces, about the size of a nut; boil for half-an-hour to one hour, in a strong solution of common "washing soda"; pour off the disintegrated portions into a large vessel, containing clean water from time to time, and repeat the boiling in soda, as also the pouring off, until the whole mass is perfectly broken up. When all the material in the large flask or vessel shall have thoroughly settled down, it should be subjected to several washings in order to remove the soda, the material being allowed to settle thoroughly after each washing. It should then be removed to a beaker or wide-mouthed bottle, which should be filled up with water, and after being thoroughly stirred or shaken up, the material should be allowed to settle for thirty seconds only, and the supernatant fluid and its floating particles poured off into a large vessel. Repeat this three or four times, and it will give the heaviest density of sand and polycistina. Repeat this process with the matter in a large vessel, allowing it to settle for two and a-half to three minutes, and the density containing the small polycistina will be obtained. Treat the remaining matter the same, and allow it to settle in six inches of water for twenty minutes, and the density, consisting of the *débris* of Polycistina and of diatoms, will result. Now, boil each separate sediment in nitric acid for fifteen or twenty minutes, remove all

trace of acid by repeated washings. Boil finally each density in a weak solution of bicarbonate of soda in a test-tube of large capacity for an hour. This will remove all flocculent matter. After repeated washings, perfectly clean Polycistina will be obtained. The heaviest density, consisting of sand and the largest Polycistina, should be placed in a test-tube with about three inches of water, and subjected to rotatory motion. This will cause the Polycistinous shells to rise above and to free themselves from sand. They are then poured off in a wide-mouthed bottle or beaker, the sand being left at the bottom of the test-tube. This must be very carefully conducted, and repeated to see that no large and perfect shells may be left in the sand. Each density should then be bottled in distilled water. Polycistina may be mounted dry, as diatoms or in balsam. Beautiful slides can be produced by calcining the shells upon a piece of thick platinum foil or in a small platinum capsule, and mounting them "opaque." The neatest and best method of preparing such slides is to make a disc, half-an-inch in diameter, in the centre of a slip, allowing it to harden for some days. A half-inch cover is then cleaned, and a sufficient quantity of balsam, thinned with turpentine, put upon it. The Polycistina are then to be placed in the balsam in sufficient quantity to form a surface over the cover when evenly spread upon it. The cover, with the Polycistina, is then to be put aside for from twelve to twenty-four hours, in order that the balsam may thoroughly permeate the forms and all air escape. Now harden the balsam by gentle heat, and the cover is to be laid on the slip, balsam side upwards, and held under the flame of a Bunsen burner until the balsam is liquified. The Polycistina are then to be evenly spread upon the cover by means of a needle. When the balsam is cold, a small drop of benzole or balsam is to be placed upon its surface, and a clean half-inch cover to be warmed and carefully lowered upon the balsam. The Polycistina is thus between *two* covers. Now turn the mount over, so that the under surface of the lower cover shall be upwards. Coat this over with asphalt, and put aside for a day or two to harden. Then upon the asphalt disc on the slip place a small drop of (cold) "French liquid glue." Place upon this the asphalted under-surface of the mount, and when the glue is quite dry finish off the slide with either asphalt or zinc cement. V. A. L.

326.—Preparing Rock Sections.—How far G. H. B. can dispense with lathe and diamond-powder in preparing rock-sections depends very much upon whether the rocks he wishes to prepare are silicious or not. Silicious rocks or fossils are extremely difficult to tackle without proper apparatus. Limestones, and the softer rocks and fossils, are very easily ground with emery or even pumice-stone powder. I have some reason to believe that

professional lapidaries do not use so much diamond-powder as they pretend, but like to talk of it, as it seems to enhance the value of their work. Suppose G. H. B. wishes to grind down (say) a piece of Mountain Limestone, the plan I recommend is as follows :—Get a copper plate (I have used the back of a lady's card-plate, but it is not quite large enough) and a tin of "Wellington Knife Polish," which is in fact flour of emery, and proceed to rub down a flat surface, about half-an-inch square, on this plate with emery and water. Having obtained this surface, wash the specimen carefully, so as to get rid of every grain of emery, and then grind the same surface on a school-boy's common slate, so as to get rid of the scratches the emery has made. You can then proceed further to polish the surface on a smooth deal board, rubbing against the grain, but this is not necessary. A piece of rock which seems covered with scratches when dry will show no scratches when it is mounted in balsam. Next, take a glass slip, or, better, a piece of thickish plate glass, $1\frac{1}{2}$ inches square. Place on it a little Canada balsam and some fragments of common shellac, in the proportion of one part of balsam to two of lac. Heat the glass over a spirit-lamp, and unite the balsam and lac by stirring with a knitting-pin as they melt. Continue to stir for a few seconds after removing the slide from the lamp to get rid of bubbles, and then press down the ground surface of the specimen into the hot mixture. Hold it pressed down for a minute, and then set the glass aside to cool. As soon as it is cold, you can begin to rub down the other side, using the glass as a handle. I generally reduce the mass on a common grindstone till I can see light through it, and then begin on the copper plate and slate again. In this way I have reduced and mounted a great many rock specimens with, generally speaking, fairly good results. When the rubbing is finished, put your slide (if you have used a slide) in methylated spirit for about an hour. You can then, with a camel-hair brush, remove the cement round the edge of the specimen, and having washed it with benzole, mount in balsam. If the cementing has been done properly, the thin film of cement beneath the specimen does not interfere with the transparency of the object. But if you have used a piece of thick glass, or if you have rubbed your slide and wish to use another for mounting, leave the whole thing in spirit for a few days in an upright position. The cement melts, and the specimen comes off and falls down. In rubbing turn the slide frequently. You are thus more likely to get an even surface, and not to rub away one side more than the other. I have used a piece of thick plate glass instead of the copper plate. When the glass gets scratched, the emery grains get sufficient hold to do their work. Coarser emery must be used if there is much work to do. G. H. B. should consult Rutley's "Study of Rocks." R. S. P.

329.—Tracing-Paper.—Paper well wetted with Canada balsam dissolved in camphine, and dried; or another kind is made with nut-oil, mixed with oil of turpentine. The paper is moistened with this mixture and then rubbed with flour. JACK.

332.—Blood-Corpuscles.—In the *Journal of Microscopy* for January, 1888, B. O. B. will find a fairly complete answer to the first part of his question in the article by Mrs. Alice Bodington, "On Micro-Organisms as Parasites." There she quotes pretty fully from Sutton, Metschnikoff, Koch, and others, to the effect that the colourless blood-corpuscles or leucocytes are the means appointed for the destruction within the organism of fungi and such invading spores as would prove hurtful to the host wherein they take up their residence. With respect to the second part of the question, I would suggest, Mr. Editor, that you give a word of advice to your printer, who has probably inserted "analysis" instead of "analogies." There is, indeed, a great analogy between the leucocytes and the amœba, both consisting of protoplasmic masses, apparently without a definite cell-wall, having the power of protruding rhizopods from any portion of their substance, whether for the power of progression or for seizing food. Both live on minute animal or vegetable particles floating in the fluid with which they are surrounded, and both have the power of self-division, in order to form new creatures. To each also belongs the power of coalescing with other animals of a similar type, so as to form a larger protoplasmic mass. In connection with these, attention should be drawn to the foraminifera and sponges, which are also protoplasmic masses, having similar powers to the amœba, but invested with either a coating of carbonate of lime or of silica. With respect to the Torula the case is different, for this organism consists of protoplasm coated with cellulose. Like the amœba, it has, however, the power of protruding a portion of its own mass as a kind of rhizopod, but apparently only for the purpose of propagating its species, and not for the sake of eating. With respect to the Bacteria, there would appear some doubt whether they ought to be classed with Amœba as animals or with Torulæ as plants. Some certainly appear invested with a cell-wall, whilst with others, such as the micrococci, it is difficult to make out a trace of such an investment, and when their movement and high refractive power are considered, they appear to approximate rather to Amœba than to Torula. J. W. G.

333.—Lobster.—Somewhere in the *Chemical News*, within the last twelve months or so, I have seen a short notice by some scientific worker, whose name I forget, of an analysis of the green gland of the oyster, in which the author demonstrates the presence

of a substance analogous to urea and also uric acid in this organ. It would, therefore, appear to fulfil the same function as a kidney, but am quite unable to find the article, although I have carefully looked through the index. J. W. G.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply. All answers should reach us before the 12th of the month.

350.—Penicillium glaucum.—What is the easiest and best method of obtaining and mounting for permanent specimens *Penicillium glaucum?* S. A. Oliver.

351.—Intestine.—Can anyone give me the method to show the villi of the intestine in an upright or vertical position, injected or otherwise, as Mr. Norman's slides are done as opaque mounts? L. E.

352.—Olfactory Mucous Membrane.—What is the usual method for preparing specimens of olfactory mucous membrane to illustrate all details? H. A. Parker.

353.—Ear, Human.—Will anyone oblige by giving directions for beginners to prepare good specimens of the ear (internal)? H. A. Brierley.

354.—Objectives.—How is the focal length of microscopical objectives measured? Amateur.

355.—Starches.—What is the best medium for mounting starches? J. D.

356.—Labelling Histo. and Path. Cabinets.—What is the best and most convenient way to catalogue and arrange this class of specimens—by organs, as nervous system, respiratory, circulatory, etc.; or alphabetically from organs, as liver, lung? I should be glad to hear in an early number. Vid.

357.—Phosphorescence.—Can anyone explain the cause of phosphorescence in fish? Is it due to micrococci? Scientific.

358.—Pollen.—What is the best method for cultivation of pollen spores? Botanic.

359.—Thorax.—What is the best method for making a transverse section of fœtal thorax, showing all the parts *in situ?* Histo.

360.—Urinary Deposits.—What is the best and simplest way of staining and mounting urinary deposits? PHYSICIAN.

361.—Plants.—How is it accounted for that plants under the influence of sunlight by day emit oxygen, whilst at night they emit carbon dioxide gas? W.

362.—Double Rose.—Assuming that the double rose is an artificial product, I should much like to know when it was first produced. Is it known whether the roses which the Roman poets (Horace, for instance) speak of were the artificial double or the natural single rose, like the rose of our hedges? R. S. P.

363.—Explosion of Potassium.—The other day, in attempting to take a piece of potassium from a bottle with the point of a dry penknife, the whole thing exploded, the mineral naphtha, as well as the potassium, taking fire and giving me a severe burn. Some months since, a morsel of metal from the same bottle, when touched, flew across the room with explosive violence. Can anyone account for this, as there was no moisture present in either case? JACK.

364.—Removing Grease.—Will any reader of the *Enquirer* kindly inform me what is the best way of removing greasiness from entomological specimens? I have seen French chalk recommended, but have been afraid to risk utterly ruining specimens which cannot be replaced, by trying it without further information on the subject. Is it sprinkled over the wings and bodies, and if so how can it be got off again without removing a large proportion of the scales? Benzine is also recommended, but although a small quantity of it does not do the specimens any harm, yet if they are soaked in it all the scales will cling together. I have tried it with partial success, but the results have not been so satisfactory as I could wish, and therefore I shall be glad of any information as to the use of French chalk.

G. H. B.

Photographic Notes.

Magnesium Flash-Light.—I would most strongly warn all amateurs against the compounds of magnesium and chlorate of potash. Unless *very* carefully used, they may have a most unpleasant "blow-up" when they least expect it. Gun-cotton works very well, but cannot always be procured. "Schultze" or "Coohal" powder will do just as well, and can be had from any gun-maker. It will easily powder between the fingers, and can then be mixed with the magnesium powder. A very handy lamp for burning it in is made out of a 5-H. "E. C." or "Schultze"

powder-canister. Cut out the front and top. If the sides are bent back a little, it is better. A small hole can be cut in the back to pass a taper through to light the mixture. It is well to stand the lamp on an old tea-tray, as a very great heat is given out during combustion. *Keep the sitter's eyes from looking at the light, and wear a pair of blue glasses yourself.* If the room is well lit with gas, the brightness of the flash is not felt so much.—H. H. Williams.

Printing from a Broken Glass Negative.—Having had the misfortune to find a crack in one corner of a very good negative, to cut off the crack would have spoiled the picture. I tried to print from the cracked glass, and got one good print; but in attempting to get another print, the crack ran across the plate and the print was good for nothing. I had a mixture of turpentine and Canada balsam, equal parts of each, used in re-touching negatives. I placed the negative in a frame, and then painted the crack on the glass side of the negative with the mixture; saw that it soaked into the crack, filling it; then wiped off the surplus with benzine. The copy made after printing was good, and so were all subsequent ones. The crack had not gone through the film, but only through the glass. When preparing to print the third picture from the cracked negative, I noticed a row of small beads of the cement exuding from the crack. These I washed off with benzine, and after that I washed or cleaned the cracked part each time I used the negative.—C. Sellars, in *Anthony's Photo. Bulletin.*

Keeping Silver Paper.—A noted chemist called to see me a few weeks ago, and having occasion to mention the method of keeping silvered paper as proposed by a firm in Massachusetts, I showed him one of the tin boxes containing the preservative compound. He took some of the material with him, and since has written me as follows:—"I found that the material which I took from the tin case at your house consisted simply of lime and charcoal. There was no chloride in it, so it could not be chloride of any sort. Burned limestone or caustic lime is a good and cheap absorbent of water from the air, and also of carbonic acid and acid vapours, if present. The charcoal is introduced, probably, only as a disguise." These tin boxes, weighing, say, eleven ounces each (box and all), are sold at the rate of two dollars for six boxes. It may be well for those who want to save a little to try lime freshly burned—that is, unslacked. Perhaps it will answer the purpose.—*Ibid.*

Halation in Negatives.—J. W. Lapham, in the *British Journal Almanack*, writes:—"The remedy I find most useful is to rub the portion of the negative affected by the halation with a piece of chamois leather wetted with methylated spirit. The best way is

to cover the top of one finger with the chamois and rub the negative with a circular motion, changing the part of the chamois as it becomes black, and taking care to keep it well wet with the spirit. When portions of a negative are found to be over-intense, they can be reduced by the same method."

Slow *v.* **Quick Plates.**—A writer in the *American Annual* says:—"I think it is folly to use quick-plates where it is possible to employ slow ones. Slow-plates generally contain more silver than quick ones, and therefore develop easier and quicker and secure more intensity. One or two seconds are not much in a lifetime, and a perfect negative is a very satisfactory thing. Not that perfect negatives *cannot* be obtained from quick-plates, but I contend that at least 75 per cent. more of perfect ones can be realised from the use of moderately slow-plates."

Practical Hints.

Putting Screws into Plaster Walls.—It often becomes desirable to insert screws into plaster walls without attaching them to any woodwork, but when we turn them in the plaster gives way, and our effort is vain. And yet a screw may be inserted in plaster so as to hold light pictures, etc., very firmly. The best plan is to enlarge the hole to about twice the diameter of the screw, fill it with plaster of Paris, such as is used for fastening the tops of lamps, etc., and bed the screw in the soft plaster. When the plaster has set, the screw will be held very strongly.

Gilding Ivory.—Immerse it in a solution of nitro-muriate of gold, and then expose it to hydrogen gas while damp. Wash it afterwards in water.

Polishing Oak Furniture.—A bright polish may be attained by mixing six ounces of raw linseed oil with half the quantity of vinegar, to which, after being well mixed, three ounces of spirit and half-an-ounce of antimony is added.

Coating to Imitate Amber.—A composition for the coating of wood or metals to imitate the finest amber, with brilliantly illuminated and iridescent reflecting surfaces, and in almost every shade, from the deepest yellow up to the deepest wine colour, is made from the nacreous portion of ordinary shells. The powdered material is first dried in an oven by heated air or gas, and immediately after subjected to the vapour of halogen, either in an oven or iron, glass, or porcelain vase, or a small muffler, to which heat is meanwhile applied, this heat vapourising the impregnating halogen elements applied, such as iodine, bromine, fluorine,

chlorine, or cynanogen in solution, for which alcohol or petroleum is employed.

Beautiful Imitations of Mosaics.—Have one side of plate glass roughened, or given a crystallised surface, on which trace a design in suitable opaque colours to represent the seams between the pieces composing the mosaic. Fill in a portion with transparent colours, then cover the whole surface with gold-leaf, with a backing of white and red lead, patent drier, and Japan gold-size, or any material which will protect the gold, such as amber dissolved in spirit of turpentine. The effect will be most realistic.

French Furniture-Polish Reviver.—Beat gum acacia and the white of two eggs in a mortar until they amalgamate; then add half-a-pint each of raw linseed oil and best vinegar, eight ounces of methylated spirit of wine, one ounce of hydrochloric acid, and two ounces of muriate of antimony. They are to be rubbed on the surface of the furniture till dry, and will give a brilliant and lasting polish.

Darkening the Natural Hue of Wood.—This is effected by a solution composed of equal parts of manganate of soda and crystallised Epsom salts, dissolved in twenty to thirty times the amount of water, at about 144 deg. The less water employed the darker will be the hue.

Wax Paintings for Walls and Ceilings.—The following is the latest improved style; it is also the most practical. The vehicle used consists of wax and resin, dissolved in spirit of turpentine. The mixture is fluid and of the colour of milk. In this the colours are ground, and are then preserved in small glasses, and spirit of turpentine is poured on them to preserve them. They are closed with a cushion of leather, having a button for a handle. Nearly all colours may be used indiscriminately. Prussian blue and orpiment are notable exceptions as wanting. For the ground the wall or ceiling is plastered in the usual way with lime, not smoothly, but so as to have a kind of grain or tooth. The painting is executed on the wall when dry without other preparation. When working, the colours are diluted with spirit of turpentine. The method requires expedition, as the colours dry fast. These colours have a semi-translucent hue.

Varnishing Fretwork.—Use white, hard spirit-varnish; it requires no size. The application is to be made in a warm room, or fill in the grain of the wood with glue size and varnish with brown, hard varnish.

To Coat Furniture with a Gloss White.—To make a smooth, solid surface of gloss white, without the least appearance of the grain of the wood, give the wood a priming coat of white lead, mixed with oil of turpentine and a little japan. When this is dry,

rub down the work carefully, and then coat with bleached shellac in alcohol. This prevents the grain of the wood from being raised. Then proceed with two zinc coats in turpentine, and finally with zinc in dammar varnish. There is an absolute necessity for using the shellac, as without it the natural sap will in time discolour the white surface.

Polished Floors.—A remarkable innovation has been made—that of the application of soluble glass to floors, the water-glass being previously coloured if desired. It gives a polished, smooth, and handsome surface. The seams are first filled with a cement of water-glass and gypsum; successive coats of water-glass, of the consistence of syrup, are applied with a stiff brush. A higher finish is given by pumicing off the last layer, and then putting on a coating of oil.

Exchanges.

"Cambridge Antiquarian Proceedings," 1879 to date, cost price, 44s. 6d.; also, occasional publications. Exchange for Text-books on the Microscope, Entomological or Botanical Books, or Standard Works on Higher Mathematics or Natural Philosophy.—G. H. Bryan, Thornlea, Chaucer Road, Cambridge.

Dragon Flies.—Mr. W. Harcourt Bath, Ladywood, Birmingham, desires to correspond with students of the *Odonata* in all parts of the globe, as he is specially working up this group of insects. Specimens for figuring in his forthcoming "Monograph of British Dragon Flies" will be very acceptable. There is probably no class of insects so neglected as Dragon flies, and Mr. W. Harcourt Bath will be very pleased to assist anyone desirous of commencing their study.

The following well-mounted and neatly finished Micro Slides for exchange:—Cystolitus of *Cactus;* Cuticle of *Cactus*, in C.B.; Cuticle of *Anasassa sativa*, showing large stomata, in C.B.; Scale of the *Sudak*, a Russian fish; Pollen of *Salvia patens*, in C.B.; Section of *Dammar Wood*, in C.B.; Skin of *Sturgeon*, with bony plates *in situ*. Approval to be mutual.—Rev. H. W. Lett, M.A., Aghaderg Glebe, Loughbrickland, Co. Down.

British Medical Journal, June, 1883—Dec., 1885, 5 vols., complete, unbound. What offers in microscopic, botanic, entomologic, or other books, periodicals, apparatus, or cash?—G. H. Bryan, Thornlea, Trumpington Road, Cambridge.

To our Readers.—The Editor will be glad if correspondents will send him *marked* newspapers or periodicals containing notices of Scientific Meetings and other items of interest.

The Scientific Enquirer.

MAY, 1888.

Rotifers.

By J. C. Webb.

PROBABLY there are few microscopists who do not experience a greater interest in the examination of living objects than in that of inanimate ones, and there are few objects more readily obtainable than these wonderful animalculæ. Scarcely any of the leaves or branches of our common water-plants can be examined without revealing some of these pretty little creatures nestling among them, while they are frequently to be found in moss on old walls and even in the gutters of houses, where trees are close at hand; indeed, my own supply was, like the excellent old Leuwenhoek's (who first directed attention to Rotifers), derived from the latter source.

The Rotifera form a most interesting study, so let us glance at their organisation. There are several kinds, varying materially in size and shape, the males being more perfectly organised than the females.

If we place some of these wonderful creatures in a live cage, and examine them with the inch power of our microscope, we shall get a better idea of their structure and habits. The first things we notice when we get our glass into focus are some little yellowish bodies, of an irregular oval shape. Watching one of these, we presently observe a slow bulging at one end and then at the other. The oval suddenly elongates itself into a form not unlike a caterpillar, except that there is a tapering at one end. Now a forked tail becomes visible. This fixes on to the glass, while the body sways to and fro. Presently the head is drawn in, as if it were swallowed, and suddenly in its place are unfolded two broad membranes, having each a circle of waving cilia, which bear a very striking resemblance to wheels, and which appear to revolve with great rapidity, while at the same time the jaws

commence to work in a manner so like the pulsations of a heart that they were at one time mistaken for that organ. They may be seen either swimming rapidly through the water by means of the vibratile cilia, called "wheels," or crawling along the side of the glass, fastening to it by the head, and then curving the body until the tail is brought up to the spot, which is then fastened on to the glass and the head set free. They may also be seen fastened to a weed or the glass by the tail, the body waving to and fro, or thrusting itself straight out, and setting the wheels in active motion.

One thing which has greatly contributed to the celebrity of these creatures is their powers of resuscitation. Leuwenhoek described the slow resuscitation of the animal when in a condition as dry as dust, directly moisture was brought to it; and shortly after another eminent observer startled the world with the announcement that this drying and moistening could be repeated over a dozen times in succession, so that the Rotifer, whose natural term of life seldom exceeds eighteen days, could, according to this theory, be dried and kept for years and revived by moisture at any time. With regard to this last statement, there has been much difference of opinion; but there is no doubt as to the fact that the Rotifer has a wonderful power of suspending animation, though the experiments that have been made would tend to show that, in order to ensure its resuscitation, it is a *sine qua non* that it should be surrounded by a certain quantity of sand, so as to prevent the animal from becoming *actually* dried. Whenever it is completely separated from dirt and is *really* dried, it perishes. Anyone who doubts the truth of this assertion can easily test it by placing some rotifers in a watch-glass without dirt and some in a watch-glass with dirt or moss, and allowing them to dry. They will find that the addition of a little water to the animals surrounded *with dirt* or moss will cause them to revive; while those that were dried in the watch-glass *without dirt* will defy all efforts at resuscitation. They may swell a little and elongate themselves, but they will not revive. A Rotifer once *thoroughly* dried is dead for ever. The reason why Rotifers ever revive is because they have not lost by evaporation that small quantity of water which forms an integral constituent of their tissues, and it is the presence of the dirt and moss which prevents this complete evaporation.

While on the subject of the extraordinary vitality of Rotifers, I will relate, for what it is worth, an anecdote that was told me lately. A gentleman who had invited some friends to come and see his collection accidentally left his bottle of Rotifers out in the garden, and as during the day there happened to be a somewhat severe frost, when he returned home in the evening he discovered the water containing his treasures frozen into a compact block of

ice. He at once came to the conclusion that his Rotifers were dead; but as it was too late to ask his friends to postpone their visit or to get fresh objects, he resolved to try the effects of gently thawing them before throwing the bottle away. With this object he placed the bottle on the hob of the fire-stove, but once more something happened to divert his attention, and the Rotifers were forgotten until the water containing them was in an almost boiling condition. Now, he thought if the frost had not killed them the boiling had; but judge his astonishment when he examined some of the water under his microscope to find the Rotifers not only alive, but in a more active state than he had ever before witnessed them, and his friends, after all, enjoyed a first-rate evening.

Every microscopist who has not already examined the real objects should lose no time in securing specimens and doing so, for it is by such examination alone that it is possible to fully realise the marvellous perfection which God has displayed in one of the smallest of His creatures.

Tenants of a Season.

SLOWLY the hard hand of winter relaxes from the sleeping land. The purple buds are thick on all the trees. In the copses the woodbine and the briar are fretted with tufts of dainty foliage. The white clusters of the sloe cling to bare black stems like the last trace of lingering winter. And although there is but scanty cover yet in wood and hedgerow, the birds even now in quiet nooks and unfrequented corners are beginning to build. Already the missel thrush has put the finishing touches to her great nest in the apple tree, where, without a leaf to hide it, it stands plain to all the world. In banks and walls robins have long been busy with their early broods. The magpie is lacing more sticks among the outworks of his citadel. The rookery is in an uproar with the hoarse clamour of its sable tenants. In many a budding elm the song thrush is singing to his mate on her nest in the thicket below. The mellow whistle of the blackbird, the cheerful cadence of the chaffinch, and now and then on bright days the music of the lark tempt us to forget the lingering bitterness of the winter and dream of May-day flowers and summer sunshine.

Most dexterous architects are these children of the air. The nests of some of them may seem by comparison rough and undecorated structures, built for use and with little claim to beauty. The jackdaw blocks the turret stairway with a pile of

rubbish that looks like preparations for a bonfire. The ringdove trusts her eggs to a real platform of sticks woven so carelessly that their white forms are often clearly visible from below. Some birds, whose lives are passed chiefly on the ground, make no nest whatever, and their young can run—in some rare cases, even fly—as soon as they leave the shell. But the nests of others, though used only for a single season, are marvellous works of art. The palm for clever building must undoubtedly be awarded to the long-tailed tit.

In a quiet corner of the meadow, where the dubious path is seldom worn by the foot of man, a thick briar bush, standing out from the hedge, leans over the little brook that under its canopy of fresh green hart's-tongue wanders by unseen. In the thorny tangle of the briar a pair of these skilful weavers will set to work upon their dwelling, and the fast-opening leaves of April will soon draw over it a green veil. The structure is indeed a triumph of the builder's art. Without, it is an oval ball of moss felted with wool and hair, and thickly studded with scraps of grey lichen from the stems of ancient trees. Within, it is cushioned so deeply that nearly three thousand feathers have been counted in a single nest. All this is finished in a fortnight or less from the first layer of moss to the last feather in the lining. The entrance is at the side—a tiny hole, not always easy to discover. How eight young birds find air to breathe in such close quarters, and how their parents contrive to feed them all in their right turns, must ever remain a mystery.

The long-tailed tit has neither equal nor second, but perhaps no bird approaches her more nearly than the wren. The materials she chooses vary with her surroundings. Here, skilfully woven of green moss, the nest fills a hollow in an old stump so naturally that among fringes of lichen and dark festoons of ivy it seems but the growth of time. There, under the brown eaves of an ancient barn, it is a delicate fabric of dry grass harmonising exactly with the stained and weathered thatch. Now, in a chink in the crumbling ruin, its greys and browns are in perfect keeping with the tints of the time-worn masonry. Now, cradled in the arms of the giant ivy, it seems but the handful of dry leaves that the winds of autumn heaped into the hollow. Many a time would it escape notice altogether did not the alarm notes of the builder, like a miniature watchman's rattle, as she flits uneasily in and out of the hedgerow, betray what she fain would hide.

Birds in general are jealous of any meddling with their nests; but the wren is particularly fastidious. Many nests are built and never finished; and should her sanctuary be touched in her absence she will detect the profanation in a moment, and will probably abandon her eggs without further ceremony. The wren

lays eight eggs, and frequently rears a second brood in the season. If all the young survived, there would be at the end of ten years no fewer than two thousand millions of descendants to a single pair. What ghastly tables of mortality the annals of the race would furnish! The ivy-crowned ruins of the long dismantled mill whose memory goes back to the days of the old Norman survey is the haunt of many a shy-feathered builder. In their favourite nook, draped with dark trailing moss, glittering with drops from water that still plashes down where it fell a thousand years ago, a pair of dainty wagtails make their nest year after year safe from all invasion, unless perchance the visit of an unprincipled cuckoo.

Niches in the ancient walls are tenanted by the robin and the oxeye; among the sheltering ivy the chaffinch weaves her nest. High up in the great sycamore that spreads its broad arms over the ruin a crow has built himself a fortress destined ere long to be harried by some angry farmer, and the thief himself, slain perhaps red-handed, hung up as a warning to his fellows. Along the wandering banks beyond, overshadowed in summer by a cool canopy of marestail and meadow-sweet, there lingers yet a relic, it may be, of far-off feudal days. Far among the tangle of the winter thickets, peering shyly out here and there between the glossy hasel stems, wild snowdrops, wild since Norman times, hang their graceful heads, far more lovely the naturalist fondly thinks than their statelier sisters of the garden. Now the meeting streams widen out into the river. Dark alders and grey willow trees lean over the water. Broad belts of sedge and rushes line the shore, set here and there with fiery clusters of marsh-marigold. Here in winter the snipe get up, with strange cry and devious flight; and the water-rail steals silently away under the bank, or, as she flies to cover, leaves a silvery path with her trailing feet. Here, too, in springtime, the shy moor-hen cautiously anchors her broad nest of flags out in mid-stream among brown stems of rustling reeds. Later on she will lead out her dusky brood on these tranquil waters. He is a happy man who catches sight of the little crew as they make their first plunge into the world. A single day old perhaps, they do not hesitate at the approach of danger to scramble over the edge of the nest and swim boldly after their anxious mother to safer shelter on the opposite shore. Little balls of black down, with a touch of vermilion for a beak, they venture fearlessly on their first cruise, diving under obstructing logs or steering carefully through a fleet of lily leaves with the coolness of a practised hand. Sometimes a low-hanging branch will shipwreck unawares a little argonaut and turn him on his back, kicking his long yellow feet helplessly in the air until righted by a dexterous touch from the parent's bill.

In a corner of the orchard yonder, as the spring wears on, the redstart will settle down after her wanderings, and in the ancestral hollow in the moss-grown tree will brood over her beautiful blue eggs, while her handsome mate will sing to her from the branch above the briefest of lyrics indeed, but glowing with the rich music of the south. The swallow will come north across the far Sahara and find her way back to the old shed on whose blackened rafters her nest has hung so long. The white-throat and the chaffinch, and many another rover, will return and join the musical throng that weave their fairy homes among the leaves. Let no hasty hand disturb them, or too curious eye drive them from their accustomed haunts. It is strange that any could be found to tear down the dainty fabric and scatter its contents on the ground. But alas! we are all familiar with the birdsnester, who on mischief bent strolls along the lane with a nest of gaping fledglings in his hat and a string of birds' eggs in his hand. He is a young barbarian, the aversion of the old ladies of the parish. The parson has got his eye upon him. He will come to a bad end, after a career of depravity, punctuated by ineffectual birchings, solitary confinement, and the treadmill. But there is happily a birdsnester of a different stamp altogether, upon whose conscious ear there never falls the accusing plaint of the robin or the lament of the plundered song thrush. The flycatcher builds fearlessly in his trellis; the very oriole might trust her eggs within his reach. No bird that flies will find an enemy in him. He delights to watch and not to plunder; he finds his pleasure among the living rather than the dead. The tenants of the tangled coppice are yeomen of his manor; he is proud to reckon on his list of friends a score of singers

> Whose household words are songs in many keys,
> Sweeter than instrument of man e'er caught;
> Whose habitations in the tree tops even
> Are half-way houses on the road to heaven.

—From the *Daily News.*

Short Papers and Notes.

Lighthouse Illuminants.

MR. J. Wigham, M.R.I.A., recently delivered a lecture on the above to the Belfast Natural History and Philosophical Society. The great gas lighthouse lights with which his name is identified, especially those recently erected at New Island in Belfast Lough and at Tory Island, were exhibited in actual operation, and compared with the

oil lamps used in lighthouses, and also with the electric light, which was also in operation. Mr. Wigham also explained several new inventions of his connected with lighthouse illumination, which presented features of much interest. One of these was for a light of equal intensity to the electric light, but combining great volume with its intensity, and, furthermore, having in itself that predominance of red and yellow rays which renders it suitable for penetrating fog. Mr. Wigham also exhibited a perfectly new method of illuminating lighthouses which he called a fourth illuminant. This plan consists of supplying air under pressure to lighthouse lamps, so as to surround the flame with a cylinder of air and do away with chimney glasses, and thus avoid a serious element of expense and danger.—*English Mechanic.*

The Lick Observatory.

Our American contemporary, the *Iron Age*, states that serious defects in the construction of this observatory will delay the time for fully demonstrating the power of the great telescope. The most serious is the mounting of the telescope on a hollow iron pier 30 feet high, with extra elevation, it is claimed, was not needed on a mountain 4,000 feet above the level of the sea. Owing to its extremely great power, the telescope is so sensitive that the placing of a man's hand on the hollow iron pier is sufficient to throw the star entirely out of the field. This can only be obviated by the removal of the present pier, and the building of a solid one of brick or stone, or else placing the base of the instrument directly upon the summit of the mountain. Another serious fault is the removable floor for the great dome. Experience has demonstrated that instead of five it requires fifty minutes to effect the desired change of position of the floor, by which time the object of observation would, necessarily, be in a different place in the heavens.

Medicinal Qualities of Onions.

The free use of onions for the table has always been considered by most people a healthy and desirable vegetable, and but for their odour, which is objectionable to many, they would be found more generally on our dining-tables. For a cold on the chest there is no better specific, for most persons, than well-boiled or roasted onions. They may not agree with everyone, but to persons with good digestion they will not only be found to be a most excellent remedy for a cough and the clogging of the bronchial tubes, which is usually the cause of the cough, but if eaten freely at the outset of a cold they will usually break up what

promised, from the severity of the attack, to have been a serious one.

A writer in one of our medical journals recently recommended the giving of raw onions to children three or four times a week, and when they get too large and strong to be eaten raw, then boil and roast them, but not abandon their free use.

Another writer, advocating their use, says :—"During unhealthy seasons, when diphtheria and like contagious diseases prevail, onions ought to be eaten in the spring of the year at least once a week. Onions are invigorating and prophylactic beyond description. Further, I challenge the medical fraternity or any mother to point out a place where children have died from diphtheria or scarlatina anginosa, etc., where onions were freely used."—*Scientific American.*

The Kola Nut.

Kola is regarded as of vast importance amongst the African tribes—in fact, as a sacred emblem. It is employed by the chiefs at State Councils, and an exchange of white Kola signifies friendship, while red Kola implies quite the opposite sentiment. An offer of marriage requires from the love-sick swain a present of white Kola for the young lady's mother, and the return of white Kola is a satisfactory answer ; red Kola, on the other hand, shows that the lady declines.

Experiments made with Kola prove, it is stated, that it renders foul water innocuous, tainted meat edible, and that it clarifies and improves beer. It has given the most excellent results as a cure for the drink craving, and as a "pick-me-up" its action is most satisfactory. A contemporary says :—"Some who have used the nut-paste as a 'pick-me-up' assert that, while removing the well-known nausea, it gives them a strong dislike to the smell of spirits for some days. But it is in the paste and chocolate form that it will be found of greatest advantage. If the paste is mixed with cocoa it gives a chocolate of superior and finer quality. Chocolate made with Kola paste is five times more nutritious than chocolate made with cocoa. A working man can, on a single cup of Kola chocolate taken at breakfast time, go on with his work through the day without feeling fatigued. Though it may not directly feed the muscular system, it has the property of preventing the rapid waste of the tissues. So much have the manufacturers of chocolate, both in this country and on the Continent, become alive to the excellent properties of the new paste, that they are making arrangements to procure it for mixing purposes, as soon as its price becomes reasonable. The British Government, too, have gone the length of undertaking to test and experiment with it, so as to

ascertain the saving which would be made, in the transit of provisions in time of war, by giving this beverage to the army. Dr. V. A. Stok, military doctor in the Netherlands army, is convinced that it can produce a very good drink for the army and navy hospitals."

It has been used with great service in dysentery and diarrhœa, and in all cases of nervous depression.

Mr. A. E. Floyer, the superintendent of the Government telegraphs of Egypt, considers Kola chocolate excellent for expeditions. He and his servant did ten hours' very severe climbing, slept on the rocks, did ten miles more next day, and arrived at the camp in capital spirits, though all their nourishment during that period was (between them) four biscuits, three oranges, and three tablets of Kola chocolate—practically nothing but Kola. A cup of Kolatina taken at breakfast or at supper time regularly, or a cupful between meals, will produce a beautiful and stimulating effect on the system, replacing the craving for drink, and finally curing the patient of dipsomania. The great advantage in its use for this purpose is the fact of its being pleasant to the taste, and in the patient taking it without suspecting why it is administered.

A comparison between the composition of Kola, tea, coffee, and cocoa, shows that the proportion of caffeine is higher in Kola than in any of the others, and it has more theobromine than cocoa. The average quantity of caffeine in Kola is about 2½ per cent.

The introduction into the stomach of three grains of caffeine, or the contents of one small nut, has the wonderful effect of sensibly reducing the decay of the system. Consequently the necessity for food to repair it will be lessened in equal proportion. —*Monthly Mag. of Pharmacy.*

Ripe Coffee at Kew.

A plant of the common coffee *(Coffea Arabica)* is now loaded with ripe fruit in the palm house at Kew. Seldom even on tropical plantations is a tree to be seen with such a crop. Such an object-lesson should not be missed by those who take an interest in economic botany.

Meteoric Iron.

A meteor which fell in South Carolina with a fearful crash, awakening people in their beds for miles around, has recently been analysed with the following results :—Iron, 85·33 ; Nickel, 13·34 ; Cobalt, 0·87 ; Phosphorus, 0·16 ; Carbon and Sulphur, traces, 99·70. By etching on the polished surface with nitric acid the curious Widmannstätten figures are fully brought out. There is a curious circumstance in connection with meteoric iron, namely, the

constant presence of *nickel* combined with it; and yet when we endeavour to produce an alloy of nickel and iron we get nothing that resembles a meteorite. It is evident that a great mystery still underlies these wonderful natural productions, and that we must look to chemistry in order to solve it.—*Mon. Mag. Pharmacy.*

A Blizzard.

A blizzard means something as nearly as possible like the sand-storm of the desert, with pulverised ice in the place of sand, and a temperature as many degrees below freezing as the other marks above. At the same time there is a tremendous wind velocity, equal to that of the most violent gales of the stormy season at sea. The details of the late visitation in the United States may be used to illustrate the "simoom" of Old Testament Scripture, the possible cause of the destruction of Sennacherib's host; for the *British Medical Journal* points out that "death is not due to the cold, but to suffocation; the unparalleled suddenness and extent of the fall of temperature converted the snow into ice-crystals, which were ground by the gale to a fine, dry ice-dust, and the air was then rendered quite unfit for respiration," as it is when filled with fine sand, in the dreaded storms of the Sahara.—*Sun. Sch. Chronicle.*

Photographic Notes.

New Chemicals.—Photography, which during the last five-and-twenty years has introduced a considerable number of new chemicals into the market, has not yet had all its demands satisfied in this respect. We glean from the *Moniteur de la Photographie* that *hydroquinon* has now become a recognised agent for the development of gelatine-bromide plates in France, as in this country and in America. The gradual production of the image is thus made to occupy the space of half-an-hour, the details coming out with great beauty, and the shadows being very transparent. Another new chemical, which has lately been somewhat extensively used in photographic development, is the bisulphite of potash, which appears to possess certain advantages over the corresponding soda-salt hitherto used. The moderate price of *Magnesium*, due principally to its use in photography, enables the photographer to obtain portraits at night with the greatest of ease; the guests at balls and festivals are thus taken in evening costume,

and celebrated histrionic performers on the nights of their appearance, etc. The mixture of Dr. Piffard, in which about one gramme of magnesium powder is sprinkled over half a gramme of gun cotton, placed on a sheet of metal, is very useful in this respect. The mixture is deflagrated at about three yards from the sitter, and the quantities mentioned are just sufficient to obtain an excellent portrait. The colouring matter, *eosine*, is now in considerable demand for preparing what are termed orthochromatic plates, and a large number of other organic or coal-tar colouring matters are at present being assayed for the same purpose. *Bichromate of ammonia* is being used in many printing establishments in lieu of bichromate of potash. The new "*photochlorides*" are also likely to find practical application in the same manner.

To make Ruby Glass.—There was recently published in the *Philadelphia Photographer* a method for producing ruby glass (nitrate of silver and gelatine). I had worked out a practical formula, viz. :—

No. I.

Gelatine (Heinrich's)	150 grains.
Water	6 ounces.
Chloride of Ammonium	3 grains.

Soak for one hour, melt, and add No. 2, drop by drop, stirring with a glass rod.

No. II.

Water	½ ounce.
Nitrate of Silver	30 grains.

To produce a very fine chloride of silver, filter through two thicknesses of flannel, at a temperature of 100° F. ; coat the cleaned warm glass with this, using one ounce of the compound for each 10 by 12 glass. A levelling-stand must be used to preserve an even coating. All of the work can be done in white light. Dry the plates and expose to sunlight. A deep orange ruby glass is the result. It is very safe for all sensitive plates.—Wm. Bell, in *Philadelphia Photographer.*

Retouching Unvarnished Negatives.—Powder a small piece of rosin ; sprinkle a glass plate with the powder thus obtained, mixed with about one-third of its volume of cigar ashes, so as to render the rosin less viscous, less glutinous. The mixture is placed in a clean little gauze bag, well washed, and with it touch the plates that are to be retouched. It suffices to take a very small quantity on the end of the finger, and pass it lightly over the places that need retouching, to render the coating mat apt to receive the pencil.—*Photo. Archives.*

Practical Hints.

Fixing Indian Ink.—Indian ink is composed of the finest ivory black and a gelatine size, and is excellent for plans and drawings until any colour, "wash"—or even a little dampness—comes near the lines, when they then either "blur" or "run" together. This may be prevented by dissolving in the water used for rubbing up the ink about eight grammes of bichromate of potassium, or six and a-half of the corresponding ammonium salt, per fluid ounce.

Razor-Strop Paste.—Emery for preparing razor-paste is better obtained by pounding the coarse kind thoroughly in a mortar, and throwing it into a large jug of water, and stirring well. Immediately the large particles have sunk, pour off into a shallow vessel, and let the water evaporate. This emery is better than that prepared at the emery mills. (1) Take of this emery, 2 parts; spermaceti, 1 part; mix together, and rub over the strop. (2) Jewellers' rouge, black lead, and suet, equal parts; mix. (3) Levigated oxide of tin (prepared putty powder), 1 ounce; powdered oxalic acid, ¼ ounce; powdered gum, 20 grains; make into a stiff paste with water, and evenly and thinly spread it over the strop. With very little friction this paste gives a fine edge to the razor, and its efficiency is still further increased by wetting it.

Silver-plating Fluid.—A new silver-plating fluid of great value is thus described in the *Polytechnisches Journal*:—Dissolve 500 grains of potassium iodide in 16 ounces of distilled water, and to the mixture add 666 grains of silver nitrate, dissolved in a similar amount of distilled water. The fluid thus formed is not affected by light, will keep indefinitely, and requires a very weak amount of electricity for its decomposition. Articles silvered by this process should be washed in a solution of potassium iodide, in water (1 part of the former to 4 of the latter), before polishing or burnishing.

Nutritive Solution for House Plants.—The following is said by the *Droguisten Zeitung* to be excellent:—1 part each of potassium carbonate, potassium phosphate, magnesium carbonate, and sodium silicate; 2 parts of potassium nitrate, and 3 parts of sulphate of iron, are dissolved in 2000 parts of water. A little of the solution is poured around the roots of the plants from time to time. This solution, or one very similar, was suggested by Liebig many years ago, and is highly prized by those who have used it.

Cleaning Brass.—It is a great mistake to clean brass with acid. It very soon becomes dull after such treatment. Sweet oil

and putty powder, followed by soap and water, is one of the best mediums for brightening brass or copper. To frost brass-work, and give it an ornamental finish, boil the article in caustic potash, rinse in clean water, and dip in nitric acid till all oxide is removed; then wash quickly, dry in warm boxwood sawdust, and lacquer white warm.

Answers to Queries.

325.—Weight of the Earth.—Such an expression, or enquiry, is really meaningless. What *is* the weight of anything? Simply the pressure or force exerted by a body in the direction of the earth's centre. The substance manifesting weight must therefore be something distinct from the earth itself. What really is meant by the question "What is the weight of the earth?" probably is, "What would a body, similar in all respects to the earth, weigh, if brought close to the earth?" F. S. S.

331.—Canada Balsam.—For mounting perfectly hard objects, as diatomaceæ, foraminifera, polycistina, or spicula, ordinary balsam obtained by heat is best, and in the case of diatomaceæ the turpentine existing in the balsam should to a great extent be evaporated before the cover is put finally down, otherwise the refractive index will be too low to show the markings properly. Most other objects will not stand the heating requisite to soften viscid balsam, and if they would, there might frequently be danger of producing vapour bubbles, which take some time to disappear. For this reason when we are mounting sections, insect parts, botanical objects, and the like, the balsam should always be thinned. With regard to the relative merits of benzole and chloroform there is considerable difference of opinion, but both are much more rapid driers than turpentine. The latter medium is apt to turn "fat," owing to conversion of some of the volatile oil into resin. On the other hand, turpentine never tends to produce cloudiness in balsam; while benzine often does this, and sometimes will not mix with it at all well. For this reason I generally use turpentine with balsam. It is an excellent plan to keep only a little balsam out ready for use, and to add a little fresh turpentine when it gets thick. Unless the mounter is in a hurry to get the slides finished, its slow-drying propensities are not very disadvantageous. As I have pointed out in the *Enquirer*, for October, 1887, it will be a great advantage to expose the object in the balsam for a day or two before mounting. If this be not convenient it is still expedient, wherever possible, to harden the balsam after mounting, by placing

the slides on a hot-water cistern, in front of the fire, or where the temperature is decidedly higher than the ordinary temperature of the air. In no case will the balsam become perfectly hard under the centre of the cover, unless the slide be heated considerably, but it gradually hardens pretty well round the margin, if not hurried, although in the middle it keeps softer in proportion. The less superfluous balsam there is round the edge of the cover the more rapid will be the drying. I may mention that most mounters invariably use benzole as a solvent for balsam, despite its cloudy ways. G. H. B.

332.—Blood-Corpuscles.—Colourless blood-corpuscles have lately been discovered to have a supremely useful function in the animal system. They devour substances which have become useless in the system, and they wage war upon substances foreign to the system. In transparent skinned animals the process has absolutely been observed, by which the white blood-corpuscles, or "leucocytes," attack and devour the bacilli of anthrax; or, as in the case of absorption of the tales of tadpoles, are seen hurrying along in the circulation, loaded with the muscular *débris* they have devoured. When the leucocytes can easily overcome and devour any special bacilli, these bacilli are not harmful to the animal in question; where the leucocytes have a hard struggle the bacilli are dangerous; when the leucocytes are defeated, the disease is deadly. Most interesting accounts of the experiments on this subject will be found in Mr. Blend Sutton's *Introduction to General Pathology*, and an account intended for non-medical readers has been published in the *Journal of Microscopy and Natural Science*, for January, 1888, under the heading of "Micro-Organisms as Parasites." It is supposed, on good grounds, that the white blood-corpuscles are actively engaged in the production of the red blood-corpuscles, and that the process takes place in the "red marrow" of the bones, the spleen, and the thyroid gland. The leucocytes are developed from the endothelial layer of the body, which in very primitive organisms (such as the sponges, etc.) are engaged throughout life in devouring substances for the benefit of the community, whilst other cells propel the body, or keep up currents of water. In the highest animals, the leucocytes are still true to their original function, and are sometimes distinctively known as phagocytes. I am not aware of any difference, physiological or chemical, between the white corpuscles and ordinary amœbæ. Haëckel purposely places drawings of the two side by side, in order to show their absolute likeness. Leucocytes do not ordinarily, like free amœbæ, emit pseudopodia; they are carried along fast enough by the free current of the blood, but they can under certain circumstances, move and emit pseudopodia, precisely like amœbæ, and they feed in the same manner.

Bacteria, with all their varieties and subdivisions, belong to the vegetable world ; the saccharo- and schizo- mycetes, amongst the low fungi. VANCOUVER.

336.—Multiplied Images in Eye of Beetle.—Full information on this subject will be found in a paper by J. D. Hyatt, on "Compound Eyes and Multiple Images," in the *Journal of the New York Microscopical Society*, Vol. I., No. 2 (Feb., 1885). If this be not readily procurable, most of the necessary information may be found on referring to Mrs. Ward's little book on "The Microscope," on page 69. I may mention that similar images are produced by the valves of certain diatoms, the means of observing which, I hope, shortly to describe. G. H. B.

336.—Multiplied Images in Eye of Beetle.—Remove the assemblage of eyes by maceration, spread on a glass slide, and dry. If a pointed object, such as a pin, be then held between the stage and the mirror, by proper focussing, the image of the object will be seen in each of the lenses. J. A. HOGG.

336.—Compound Eyes and Multiple Images.—W. T. will find a long article on this subject (much too long to quote) in *English Mechanic*, for March 27, 1885, page 74, by J. D. Hyatt, reprinted from *Journal of New York Microscopical Society*.

J. W. M.

337.—Etching on Glass.—Designs are produced on glass by means of hydrofluoric acid. The glass is coated with wax, and the design is traced on it with a sharp-pointed instrument. It is then exposed to the acid, either in the form of a gas or in aqueous solution. Afterwards the glass is carefully washed to remove all acid, and the wax is removed by heat. The marks made through the wax will be found to be permanently etched on the glass, the acid having eaten into, or etched (German, *ätzen*, to corrode) the glass. The hydrofluoric acid acts on the silica of the glass, yielding gaseous fluoride of silica (which escapes) and water.

$$4\ HF + Si\,O_2 = 2\ H_2O + Si\,F_4$$

J. A. HOGG.

337.—Etching on Glass.—Warm the glass, and cover it with a mixture of bees'-wax and turpentine, using only sufficient turpentine to soften the bees'-wax, let it be spread evenly. Draw the design with a fine pointed style, then drop hydrofluoric acid on with a piece of wood, or a brush ; the glass will have a ground-glass appearance where the wax has been removed.

337.—Etching on Glass.—An easy and effectual way to etch glass is by the following process :—First heat the glass evenly in a sand-bath, and then rub it over with purified bees'-wax. If the glass is hot enough, the wax will melt and be diffused over the

entire surface. Set aside the plate to cool. The design to be put upon the glass should be drawn boldly in very black ink upon a piece of paper, and attached to the unwaxed side of the glass. The pattern is then traced through the wax with a pointed instrument, taking care to clear away all the wax in the lines. When the design is finished, put some coarsely powdered fluor spar in a vessel, together with a quantity of sulphuric acid. As soon as they are incorporated, the vessel is slightly heated, and the glass placed over the vessel with the waxed side down. When the fumes of the acid begin to rise, they attack the unprotected surface of the glass, and in about half an hour the plate can generally be removed from its steam-bath. When the wax is scraped off, the design will be found perfectly etched on its surface. B. B.

338.—Soap-Bubbles.—A reference to Vol. VIII., p. 358, of the *Intellectual Observer* will supply what information you seek under the title of "New Experiments with Soap-Bubbles," by John Broughton, B.Sc. The solution recommended is as follows: —"Dissolve one part of pure oleate of soda in fifty parts of distilled water, and to every three volumes of the clear solution thus formed mix two volumes of pure glycerine." The bubbles formed from this mixture will endure in a pure atmosphere from one hour and a-half to four hours, and occasionally much longer, but they then require to be shielded from draughts. The permanence of these bubbles depends upon the purity of the oleate of soda, which is rather troublesome to prepare. I can endorse the accuracy of the above, having myself prepared the mixture successfully. A more easy method, but not so successful, is to take 150 grains of finely-shred Castille soap, and shake it up in a bottle with half-a-pint of distilled water until dissolved; allow the turbid solution to settle and filter through blotting-paper. Use the clear solution to mix with glycerine instead of that of the pure oleate. E. Bostock.

338.—Soap Bubbles.—I find the following in my book of miscellaneous cuttings, but cannot give the authority:—(1) Dissolve 1 part, by weight, of Marseilles soap cut into thin slices in 40 parts of distilled water, and filter. Call this filtered liquid A. (2) Mix 2 parts, by measure, of pure glycerine with 1 part of solution A in a temperature of 66° Fahr., and after shaking them together long and violently, leave them to rest for some days. A clear liquid will settle with a turpid one above. The lower is to be sucked out from beneath the upper with a siphon, taking the utmost care not to carry down any of the latter to mix with the clear fluid. M.E.

338—Soap-Bubbles.—M. Plateau gives the following recipe:—"First, dissolve 1 part by weight of Marseilles soap cut into thin slices in 40 parts of distilled water and filter. 2nd, mix 2 parts by measure of pure glycerine with 1 part of the above solution in a temperature of 66° Fahr., and after shaking them long and violently leave them at rest for some days. A clear liquid will settle with a turbid one above. The lower one is to be sucked out from beneath the upper with a syphon, taking the utmost care not to carry down any of the latter to mix with the clear liquid. A bubble blown with this will last several hours, even in the open air. Or the mixed liquid, after standing twenty-four hours, may be filtered.—*From Sir John Herschel's "Familiar Lectures on Scientific Subjects,"* 1867, *p.* 287. G. H. B.

339.—Why Flowers turn White.—Flowers which are not green owe their colours to a series of compounds, which are but little understood, but which have been to some extent classified by means of the spectroscope. The changes in colour which many flowers undergo are supposed to be owing to oxidation of these bodies—*e.g.*, the Garden Convolvulus turns from pink to purple during its expansion. Cultivation effects great changes in this respect, but has a limited influence. Some naturally yellow flowers, such as the Tulip and the Dahlias, assume all shades of red, orange, and white, but not of blue; while Geraniums will acquire various shades of blue, purple, red, and white, but no yellow. Hence, plants have been divided into two series—*Xanthic*, having yellow for a base; and *Cyanic*, having blue. Either may become red or white, but cannot assume the basic colour of the other. J. A. Hogg.

343.—To destroy Beetles.—A solution of sulphide of potassium ($\frac{1}{2}$ oz. to 1 gallon) has been very highly recommended in the "Garden" during the last few weeks, as an unfailing remedy against mildew, blight, and insects of all kinds in plants. It might be worth trying in this case. J. A. Hogg.

345.—Parasites on Hedgehogs.—The hedgehog flea (*Pulex erinaceus*) is not uncommon. The hedgehog tick (*Ixodes hexagonus*) has a whitish body, with a hexagonal shield. Another species (*Ixodes megatherius*) is also found. It is of a brown colour, with an obovate shield.

346.—Flies and Pedestrians.—If the face and neck be sponged with elder-flower water (obtainable from any chemist), very little annoyance will be felt from the attacks of summer insects. J. A. Hogg.

349.—Lissagou's Curves.—I think E. B. will find the kaleidophone, invented by Wheatstone, better for tracing these curves

than Blackburn's pendulum. In this (which will be found described in Lord Rayleigh's "Sound") the curves are traced by the vibrations of an elastic bar. Take a slip of steel of rectangular cross section, the sides of the rectangle being very unequal, cut it into two parts, and after turning one part about the direction of its length through a right angle, let the two pieces be again united, so that the plane which contains the smallest thickness of one contains the greatest thickness of the other. The compound rod, thus formed, is clamped at any point below the junction, and, by varying the position of the clamp, the frequencies of vibration in the two principal planes may be made to bear to one another any desired ratio, a thing impossible if a simple rectangular bar alone be used.

For engraving the curves on glass, I suppose that a writing diamond should be attached to the free end. But it seems to me, that the resistance produced by scratching the glass would rapidly annul the vibrations, and so we should not get a good set of figures. I would therefore suggest, that a piece of cardboard or paper be blacked with the smoke of burning camphor, and the designs traced on this by means of a point attached to the end of the instrument. It would be easy, once the designs are made, to photograph them on to the glass, orif it be wanted to preserve the cards, I believe this may be done by dipping them into balsam with benzole. G. H. Bryan.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply. All answers should reach us before the 12th of the month.

365.—Divergent Series.—Can any mathematical reader inform me whether a method has ever been discovered for finding the sum or value of a divergent series of increasing terms, alternately positive and negative—such a series, for instance, as $1-2+4-8+16$, etc.; or $1-5+15-35+70-126+210$, etc.?

Has any *name* been given to a series, the differences between the terms of which (or the differences between the differences, and so on) are in arithmetical progression? For example, 1, 3, 6, 10, 15, etc., and 1, 4, 10, 20, 35, etc. F. S. S.

366.—Snow-Plant.—Will someone give us a complete life-history of the "red snow" plant, showing where and how generated, whether the plant falls from the air ready formed, or do the spores only fall and then the plant grows on the snow? J. W. G.

367.—Sun putting out the Fire.—Does the sun put out the fire? If so, why so? If not, why not? CAPTAIN CUTTLE.

368.—Spathe.—What is the definition of a spathe, and shew how the bract at the base of the snowdrop flower answers to this definition? B. O. B.

369.—Fox Earth.—In many places in Derbyshire, a few inches below the surface, is found a fine, rich-looking soil, locally termed fox-earth. In it hardly anything will grow, and the farmers are very careful not to turn it up in ploughing. What is it? I should be very pleased to send a sample to anyone interested.
J. A. HOGG.

370.—To increase Specific Gravity.—How much water must be added to commercial strong solution of ammonia, sp. g. ·880, to give it a sp. g. of ·891? J. A. HOGG.

371.—Plant Constituents.—In Bentley's "Botany," amongst the inorganic constituents of plants, are given strontium, titanium, zinc, cœsium, lead, copper, arsenic, cobalt, nickel, and barium. Will someone say in what plants these elements have been met with? J. A. HOGG.

Reviews.

FORMS OF ANIMAL LIFE: A Manual of Comparative Anatomy, with descriptions of Selected Types. By the late George Rolleston, D.M., F.R.S. Second edition, revised and enlarged by W. Hatchett Jackson, M.A. Royal 8vo, pp. xxxii.—937. (Oxford: Clarendon Press. London: Henry Frowde. 1888.)

This edition was taken in hand by the late Prof. Rolleston in the Long Vacation of 1879, and was carried on by him until he left England in Dec., 1880, by which time he had completed the descriptions of Preparations 1—9 and 3 new plates had been engraved under his direction. The distinctive character of this book, as described in the preface to the first edition, consists in its attempting so to combine the concrete facts of Zootomy with the outlines of systematic Classification as to enable the student to put them for himself into their natural relations of foundation and superstructure. The foundation may be made wider, and the superstructure may have its outline not only filled up, but even considerably altered by subsequent and more extensive labours; but the mutual relations of the one as foundation and of the other as superstructure, which this book particularly aims at illustrating, must always remain the same. There are 14 excellently engraved plates.

History of the Pacific States of North America: Central America. Vol. III. By Hubert Howe Bancroft. 8vo, pp. xv.—776. (San Francisco: The History Publishing Co. 1887.)

We have before us the third of this very valuable series of historical works. It carries the history of Central America from the year 1880 to the date of publication, 1887. Vol. I. gave an introductory chapter on European civilisation at the beginning of the sixteenth century, and a summary of geographical knowledge from the earliest records up to 1540. The voyages of Columbus and his successors are narrated. Vol. II. commences with the conquest of Peru in 1530, and carries the reader on to the end of the eighteenth century. The present volume (Vol. III.) commences with 1801, and tells us how, first as a confederation and later as independent states, the people of Central America battled for freedom of intellect and human rights, and how, with their wonderful climate and resources, wealth has unfolded and commerce advanced. These are an exceedingly interesting series of books, and form no mean addition to our library.

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The World's Inhabitants; or, Mankind, Animals, and Plants. By G. T. Bettany, M.A., B.Sc. (London: Ward and Lock.) Price 6d. each part.

Parts 5 and 6 of this interesting work are to hand, which carry the reader on to Chapter XI. of the Inhabitants of Asia. They are well illustrated, and describe in a popular manner not only the Races and Peoples now inhabiting the globe, but give an account also of the principal Animals and Plants of the great continents of Asia.

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Le Procede au Charbon: Systémé d'Impression inalterable. Par M. Paul E. Liesegang. Crown 8vo, pp. 59. (Düsseldorf: Ed. Liesegang's Verlag. 1886.)

Any attempt to simplify and thereby to bring into more general use the system of photographic reproductions in carbon is a boon, and as such the neat little treatise of M. Liesegang is welcome.

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Games for Boys and Girls: A Cyclopædia of Sport and Pastime, Indoors and Out. Edited by E. D. Bourne. Crown 8vo, pp. xvi.—108. (London: Griffith and Farran. 1887.) Price 1s. 4d.

A book which is sure to please our young friends. It describes Games with Marbles, Tops, Hoops, Kites, etc., for the boys; Hopping, Skipping, and Jumping Games, etc., for girls, together with a host of indoor games for boys and girls.

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500 Practical Trade Receipts (General, Remedial, Veterinary) for Chemists and Druggists, including Approximate Formulæ of several Popular Proprietary Articles. 8vo, pp. 84. (London: Simpkin, Marshall, and Co. 1886.)

This work is in its fourth edition, and is said to contain nearly 700 receipts. Many of them, we are told, are original, and the rest have been selected from the most trustworthy English and foreign sources.

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The Island of Anarchy: A Fragment of History in the 20th Century. By E. W. 18mo, pp. 105. (Reading: Miss Langley. 1888.) Price 1s. 6d.

The incidents related are supposed to have occurred very late in the 20th century. All lawbreakers have been put to death, and the whole continent of Europe is living in one bond of brotherhood. Anarchists are branded in their foreheads with a large "O" in indelible red ink, and sent to a newly-discovered island in the South Pacific.

The Scientific Enquirer.

JUNE, 1888.

A few Geological Notes on British Columbia.

By Mrs. Alice Bodington.

WHEN I arrived last October in the new city on the Pacific, Vancouver, I looked around to see, if possible, in what part of the geological world I found myself. Not the smallest information was to be had through the pamphlets circulated by the Canadian Pacific Railway; not the smallest book on the subject in the town itself. But the very first walk showed that we were in a most interesting region. The surface-soil was everywhere clay, and, lying loose on the soil, or deeply imbedded in it, were smooth boulders, from a few pounds to many tons in weight. It was evident that we were in a region of glacial deposits. But it was not till I had access to the Canadian Government Geological Reports that I was aware of the stupendous size of the glacier which had brought these boulders with it. There is evidence from the striation of the rocks, in Vancouver Island, and on the mainland, by the presence of erratics and other undoubted signs of ice action, that a huge glacier had once filled up the Straits of Georgia, and had forced its way north and south to the ocean. The Straits at this point are seventy-six miles wide, and the glacier had spread over the land on both sides.

On the Rocky Mountains, marks of ice-action are found beyond the height of 5,000 feet. A well-marked beach of rolled stones is met with on Il-ga-chuz Mountain, 5,270 feet above the level of the sea, and moraines occur in great numbers. White silts or löess are found at a height of 550 feet above the Thompson River.

Our English notions, of the right thing to be found in special geological horizons, are much upset in British Columbia. There are immense thicknesses of carboniferous rocks, but not a trace of coal in any of them. They bear evidence in their massive lime stones of having been laid down in a deep ocean, so distant from land that only a few leaves had floated out so far. The rich coal-bearing strata of this district, from the N.W. territory to Vancouver Island, are all of cretaceous age, though some true coal is found in deposits of miocene age. This coal ranges through all stages of anthracite; of beautiful bright coal, rivalling that of the Staffordshire mines, and of lignite, and sometimes is so crushed and broken as to be useless. All depends upon the pressure to which it has been subjected by neighbouring strata, which have sometimes been overturned bodily on the top of the newer cretaceous rocks.

The geological strata of British Columbia are remarkably poor in fossils. The Cambrian rocks, not less than 12,000 feet thick, are absolutely destitute of fossils. The carboniferous contain but a few leaves, and the cretaceous, chiefly silicified tree-trunks, with a few plants and insects. In the Laramic, however, that most interesting formation, between the highest cretaceous and the eocene, remains of deinosaurs and of very primitive mammals have been found. In England, a great paleontological break occurs between the mammalian fossils of the Jurassic age and the Eocene, which is here filled up by a *fresh-water formation* of cretaceous age.

In British Columbia and the N.W. territory, eocene deposits are entirely missing, and pliocene remains are few and doubtful, but extensive beds of miocene conglomerate are found, which near the Foot Hills contain very interesting mammalian remains of existing and extinct orders of animals. I shall be happy to pursue this subject at greater length, should it prove interesting to the readers of the *Scientific Enquirer*.

Gibbon's Wrasse.

THE south coast of Devon has lately been visited by large numbers of a fish which, common enough in the Mediterranean, is seldom found near our shores. While at Dawlish on a recent occasion, I was struck, while walking over the beach to the rock-pools, at low tide, by the frequent occurrence of a very handsome

reddish-gold fish lying at my feet, which had been stranded by the ebbing tide. In shape, it was somewhat that of the fresh-water perch, and is, in consequence, as I ascertained from an intelligent old fisherman, who was "titivating" his boat on the sands, popularly known as the *sea-perch.* He informed me that it was a very rare visitor to our seas; that, in fact, he had only known it appear in any number three or four times in his somewhat long life, and, as settling the fact of its rarity on the English coast, he added that, at the Albert Museum at Exeter, there is one of a former batch of immigrants, which arrived many years ago, carefully preserved as a curiosity. Leaving my informant, and proceeding to the rock-pools, in which an unusually low tide had left all that the micro-fisher could desire, I found here and there, left by the tide, in isolated pools, living and vigorous specimens of the same lovely fish, suggesting, at first sight, the gold-fish of our window aquaria and garden-ponds, but larger and squarer in shape. The name which heads this paper is, so far as I can ascertain, correct, but I cannot find any mention of this particular species in any work of reference in my possession. Why these denizens of warmer seas should visit us at all I am not going to speculate on, and certainly not why they should select such an inclement season as the present; but, at the same time, any information on this point would be interesting. I secured a piece of the skin, having a microscopist's eye to chances, and find that it is densely crowded with scales that are very peculiar certainly, and, in *my* experience, unique. The scale itself is entire—*i.e.*, unbroken in its outline. It would, therefore, I suppose, be correctly described as *cycloid*, but at first sight it appears more decidedly comb-like than any scale I have ever met with. This appearance is due to the presence of a number of spines (forty to fifty) proceeding from the free half of the scale, inclined only very slightly downwards and directed backwards, and as each spine is about one-third the longest diameter of the scale itself, they must, without overlapping, form a perfect *chevaux-de-frise* armature, effectually protecting its owner from all enemies not very superior in size and courage. Those of my readers who remember the tortoise-shell head-comb formerly worn by ladies in their coiled-up back hair have only to imagine the teeth of that same comb springing from its plane instead of from its margin, and they have the scale of the sea-perch "to a t." Any reader who has been at all interested in this bit of gossip, and would like to have one or two of the scales to mount for his micro-cabinet, will be welcome to them as far as my stock goes, if he will send a stamped, directed envelope to "F. R. Brokenshire, 24 Oxford Terrace, Exeter."

Short Papers and Notes.

Chloride of Nitrogen.

THE dangerous quests upon which enthusiastic chemists may embark are strikingly illustrated by the case of the yellow oily substance called chloride of nitrogen. This terrible explosive was discovered in 1811 by Dulong, who lost one eye and three fingers in a vain attempt to ascertain its composition. So powerful is it that when Faraday and Sir H. Davy took it in hand they provided themselves with thick glass masks to protect their eyes from flying bits of glass, and to some extent from the irritating vapours of the oil itself. Faraday was on one occasion stunned by a detonation of only a few grains of the compound, and bits of the tube in which it had been contained almost penetrated his mask. On another occasion Sir Humphry Davy was severely injured by the explosion of a few drops under the receiver of an air-pump. Since their time the precise composition of the oil has been a mystery. At last, however, Dr. Gattermann, of Göttingen, has succeeded in its analysis. He finds that the substance examined hitherto was impure, and that the extreme danger of handling it was partly due to that fact, and partly to the varying action of light. Any bright light, he has found, is enough to produce detonation, a discovery made by the sudden destruction of his apparatus by a stray sunbeam. Chemical research now-a-days is apt to stray among the teeming pastures of organic chemistry, to the neglect of the old problems offered by the inorganic world, though the solution of these problems belongs to the highest efforts of experimental science.—*Daily News.*

The Otter at Home.

Nothing is to be seen yet in the water or on the banks. A flash of bright blue shoots over the water and vanishes in a hole in the bank. It is the kingfisher, who has made his nest in a spot secure from harm. The bird has taken my attention from the tree in the water for a few moments. There is the otter sitting on the grey trunk in the warm sunlight. He is near enough for me to study his appearance and all his movements well. Like a large cat he looks, which has been thrown in the water and crawled out. Some people think that the fur of the otter throws the water off like the feathers on a duck's back. That is not the case; his fur

protects his body in a different way. Anyone who has seen a water-rat come up on a bank after a dive will have a good idea of the general appearance of the otter's fur. Now he gives his coat a shake and combs his fur a bit with his short, webbed feet. That powerful tail of his hangs half out of the water, and his head is turned in my direction, looking for the moment just like that of an infuriated tiger in miniature, as, with ears drawn close to his head, he snarls and shows his teeth. When properly treated, the otter is easily converted into an affectionate and playful pet. For those who may not be familiar with him, let me describe his appearance more exactly. He is a trifle larger than a cat, having a very similar head, only flatter, which is provided with a fine set of teeth, and he can use them with terrible force for his size. On his lip he has a lot of strong bristles. His eyes are small and have a watchful look about them; the neck is almost as thick as his chest; his body is long and round; the legs are very short, strong, and flexible; the toes webbed for a great part of their length, and the claws on them sharp. The tail is thick at the root, and tapers off to a point. It is very powerful, as I said before, and is, in fact, his swimming machine. In colour he is dark brown as a rule, with the sides of his head and throat brownish grey. He has been sitting in the sunlight whilst I have sketched his portrait; now he thinks he will get a little more into the shade, so, with a peculiar loping gait, he moves further up the trunk and rests by the side of a large limb. Now he shows himself to perfection, and I have managed to slip down on the boards of the weir, where I lie, flat as a flounder, and can study the animal, where an animal shows himself most naturally, in his own home. There is just a little swell in the water, and his mate shows her head above the surface. She has her feet on the trunk, and is just about to join her lord and master, when a moorhen flies from the meadow into the river, squattering with her feet in the water. That is enough; with one gliding plunge, leaving not a trace on the surface, they are under the bank in their own quarters.—*Cornhill Magazine.*

Ingrowing Toe-Nail.

Begin the cure by simple application to the tender part of a small quantity of perchloride of iron, which can be readily procured at the druggist's. The tender flesh is dried and tanned by this application and ceases to be painful. When this hardened flesh has remained on two or three weeks, it can be easily removed by soaking in warm water. Further trouble can only be prevented by cutting the nails to proper shape and wearing shoes of reasonable size.—*Scientific American.*

Gelatine Plaster Casts.

Some time ago, Mr. C. W. Cathcart, M.B. (Edinburgh Infirmary), proposed a new basis for making casts of anatomical preparations. The basis is made as follows:—Take "No. 1" gelatine—say, six ounces—soak it till quite soft and swelled, afterwards dry it slowly until just pliable. As it has now the maximum of water necessary, melt it in a water-bath, and add six ounces measure of pure glycerine. When the two are thoroughly mixed, the material is ready. To render it opaque, add, while it is hot and therefore fluid, small quantities of a thick paint, made by rubbing up oxide of zinc in glycerine. When a skin colour is wanted, a little vermilion is required to give a warm, life-like hue. Should other things be cast, the prevailing colour can be given with water-colour as required (tubes of moist water-colour, sold at 2d. each, will be found convenient). Several pounds of this mixture may be made at once, and portions used as required.—*Scientific American.*

Foreign Matter in the Eye.

"A Doctor of Medicine," writing to a popular journal, says, with the sole exception of mortar and lime, it is well to remember that, no matter what it is that has got into the eye, the eyelids should be kept closed for as long a time as possible, without being rubbed or even touched. The reason for this is that there exists in the outside corner of each eye, and just under the upper eyelid, a little gland, which is constantly secreting and pouring forth a fluid which we call *tears*. This fluid lubricates the eyeball, and then runs down a little tube from the inner corner of the eye into the nose. This little gland always secretes more fluid, and fills the eyelids more quickly, under the influence of emotion, grief, or pain. In such cases, the eyeball will quickly be thoroughly washed, and the foreign body will flow with the *tear* to the bottom of the inside of the lower lid, and so pass out of the eye, through the little tube, into the nose. Then, on opening the eye cautiously, it will be found that the pain has gone, if the eye has not been touched or rubbed to prevent this natural action of the overflowing of the tear. Of course, when a speck of lime has got into the eye, this passive treatment will not do. The eye then should be immediately washed with a lotion composed of a teaspoonful of vinegar to two ounces of warm water. After this has been done for some little time, a drop or two of oil of sweet almonds should be dropped into the outer corner of the eye, which should then be allowed to rest in the dark.

Photographic Notes.

The Metric System.—The following is a list of weight equivalents and measure equivalents :—

WEIGHT EQUIVALENTS.

To convert grains into grammes, multiply by 0·065.
To convert grammes into grains, multiply by 15·5.
To convert drachms into grammes, multiply by 3·9.
To convert ounces avoirdupois into grammes, multiply by 28·4.
To convert pounds avoirdupois into grammes, multiply by 453·6.

MEASURE EQUIVALENTS.

To convert cubic centimetres into grains, multiply by 15·5.
To convert cubic centimetres into drachms, multiply by 0·26.
To convert cubic centimetres in ounces avoirdupois. multiply by 0·036.
To convert pints into cubic centimetres, multiply by 473.
To convert litres into ounces avoirdupois, multiply by 35·3.
To convert gallons into litres, multiply by 3·8.

Lamp and Reflector for the Flash-Light.—The Lamp and Reflector for using the Flash Light shown in the annexed engravings were invented by Mr. Redwood. Through the kindness of Messrs. Marion and Co., of Soho Square, London, we are

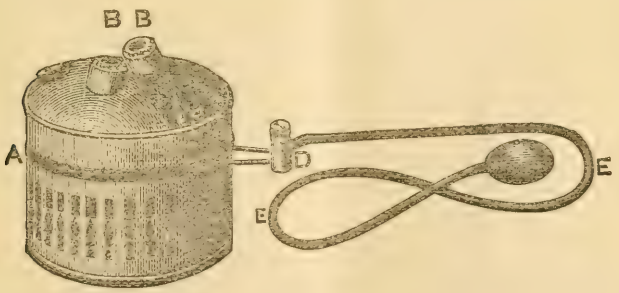

FIG. 1.

enabled to show to our photographic friends engravings of Mr. Redwood's Patent Lamp and Reflector for using the Flash-Light in taking portraits. The Lamp (Fig. 1) has two circular wicks (which only need be saturated with the spirit before lighting), inclining towards each other, through which, by means of the pneumatic

FIG. 2.

ball and tube, the magnesium powder is ejected from the cell through the two wicks, thus causing a wide flame when united, much in the same way as the flame from a 'Bray' fish-tail burner. The reservoir for the methylated spirit should not be filled, as it is only necessary to keep the wicks saturated. The Reflector (Fig. 2), as will be seen from the engraving, can be raised or lowered at will, to heights varying from about 4 to 6 ft. The blotting-boards are attached to the wire frame in order to diffuse the light, as by direct rays portraiture would be impossible. It will be observed that no gun-cotton is required with this lamp.

Description of Figures.

Fig. 1.

A.—Spirit-Lamp.
B. B.—Two Circular Wicks.
C. C.—Two tubes from Cell.
D.—Cell, holding about 15 grs. of magnesium powder.
E. E.—Pneumatic ball and tube

Fig. 2.

A.—Tin Reflector on telescopic stand.
B.—Thumb-screw to fix same at any given height.
C. C.—Holes on either side, through which the Pneumatic tube is passed.
D.—Wire Frame, to which one or two sheets of Marion's blotting-boards are attached.

The New "Flash" Light.—Our photographic friends will do well to remember that *all flash-powders containing chlorate are undoubtedly very dangerous.*

A New Transparent and Flexible Support.—M. Froedman has just discovered a new process for rendering gelatine, glue, and other bodies of the same class insoluble, by treating them with the salts of chromium, as bichromate of potash. This process also consists in transforming these bodies into colourless, transparent, and flexible membranes, by the use of sulphuric acid and its compounds. In this manner a flexible support may be obtained which can take the place of glass in the various photographic processes. For the photographic operations proceed as follows :— Take gelatine of good quality, soak it in water, and dissolve; then add bichromate of potash, and finally some alcohol, in order that the gelatine may flow more easily over polished plates. If need be, add a little glycerine to give the required degree of flexibility and softness.

Before spreading the bichromatised gelatine over the plate, the plate should be coated with Mendon chalk, then on this surface is floated collodion (enamelled), containing the necessary quantity of castor oil. As soon as the collodion sets, plunge the plate into water until the surface no longer presents an adipose appearance, and then from the warm solution of chrome salt into gelatine, and dry in a warm room. Instead of placing the collodion on the polished plate, a border may be made with caoutchouc, dissolved in benzole, to keep the membrane in place during treatment. This being done, expose the plates to sunlight or in the shade, to convert the matter into an insoluble compound. Place another border around the plate, wash to remove the unchanged chrome salt, plunge into a solution of sulphuric acid, and then wash. This membrane is adapted to receiving a photographic emulsion. Here are the proportions recommended by the inventor :—

Gelatine	... ...	3 parts.
Water ...	... ...	24 ,,
Bichromate of Potash	...	4 ,,
Glycerine	... ...	0½ ,,
Alcohol ...	... ...	4 ,,

This new and transparent flexible substance may be used for all manufactures in which similar matters enter; it can also serve as a basis for photographic prints, to be used in making transparent signs.—*Journal de l'Industrie Photographique.*

Practical Hints.

To Preserve Natural Flowers by the Wax Process.—Dip the flowers in melted paraffin, withdrawing them quickly. The liquid should only be hot enough to maintain the fluidity, and the flowers should be dipped one at a time, held by the stalks, and moved about for an instant, to get rid of air-bubbles. Fresh-cut flowers, free from moisture, make excellent specimens in this way.

Ink for Stamp-Pads.—This consists of aniline violet, $\frac{1}{4}$ ounce, dissolved in 15 ounces of alcohol and 15 ounces of glycerine added. Other aniline colours may be used if preferred.

Remedy for Constipation.—The use of whole wheat (frumenty), says the *English Mechanic*, is recommended by H. H. Hill, M.D., of Augusta, Maine. For many years he has recommended it to his patients, and asserts that it is much more useful when properly cooked in the natural state than when it has been maltreated by grinding, etc. Oatmeal he finds to be very indigestible in cases of dyspepsia, but boiled wheat is, in his experience, a perfect remedy for constipation. The wheat is to be washed clean and soaked in cold water overnight, then boiled as if it were rice until thoroughly soft, and eaten with any simple adjunct.

Cement for India-Rubber.—Bisulphide of carbon, 5 ounces; gutta percha, 5 drachms; india-rubber, 10 drachms; fish glue, $2\frac{1}{2}$ drachms. This composition is recommended for filling the cracks that occur in the rubber belts of band-saws, tyres of bicycle wheels, and rubber tubing. The sides of the fissure must be well cleaned, and the solution then introduced. If the slit is gaping, the edges may be first united by a few stitches, and the solution applied in layers. After the composition has become hard, the threads are removed, and the projecting cement shaved off with a very sharp blade that has previously been dipped in water.

Preserving the Natural Colour of Flowers.—The *Pharmaceutical Journal* draws attention to R. Hegler's method of preserving the natural colour of flowers, which consists in dusting salicylic acid on the plants as they lie in the press, and removing it again with a brush when the flowers are dry. Red colours in particular are well preserved by this agent. Another method of applying the same preservative is to use a solution of 1 part of salicylic acid in 14 of alcohol by means of blotting-paper or cotton wool soaked in it, and placed above and below the flowers. Powdered

boracic acid yields nearly as good results. Dr. Schonland (*Gardener's Chronicle*) recommends, as an improvement on the method of using sulphurous acid for preserving the colours, that in the case of delicate flowers they might be placed loosely between sheets of vegetable parchment before immersion in the liquid, so as to preserve their natural form.

Cleaning Brass.—It is a great mistake to clean brass with acid. It very soon becomes dull after such treatment. Sweet oil and putty powder, followed by soap and water, is one of the best mediums for brightening brass and copper. To frost brass-work, and give it an ornamental finish, boil the article in caustic potash, rinse in clean water, and dip in nitric acid, till all oxide is removed; then wash quickly, dry in warm box-wood sawdust, and lacquer while warm.

Care of the Eyes.—When the eyes have been used for a long time by artificial light and become fatigued, it is a useful plan to have at hand a lotion composed of rose or elder-flower water, 2 ounces; wine of opium, ½ drachm; French brandy, 1 drachm. Mix and occasionally bathe the eye with a fine piece of sponge. The grateful sensation of relief will be at once evident. It will allay inflammation and preserve the sight.

Answers to Queries.

234.—Age of Animals.—Whales live about 400 years, tortoises 150. Camels live about 50 years, oxen 20, sheep 8, dogs 14, horses 30. Elephants have been known to live 130 years after being captured. They are said to live 300 years. Eagles and swans sometimes live over 100 years. Carp have been kept over 200 years, trout for 50, pike for 90. J. A. Hogg.

262.—Coccus Vitis Vinifera.—The Coccus V. V. is unfortunately not at all uncommon in England at the present day. According to the "Vine Manual," this insect is the same species which occasionally attacks the peach, nectarine, and plum. It has a long, brown body, which in old age becomes of a blackish-brown colour, wrinkled, and short. The females are shield-shaped, convex above, flat below. They have six legs, which become part of the body with age. The insect is provided on the under side with a sucker, wherewith it extracts the juices of the plant. Soon after impregnation the insect dies, and her body becomes a shield

for the eggs, which are covered with long, white wool, as is described by White. The male has four wings; the female none. When young, both sexes are alike. J. A. Hogg.

289.—Semilunes of Giannuzzi.—To see the folds of the mucous membrane and the mucous glands of the œsophagus, Exner recommends specially that of the dog. The œsophagus and trachea of a child or rabbit, taken out and hardened together, and sections made which include the lumina of both, are instructive. The submaxillary gland must be hardened in absolute alcohol, and the sections stained in carmine and logwood. It should also be macerated in very weak chromic acid, and teased out. Minute portions of the fresh gland may also be teased out in iodised serum. I find that the structureless membrane of the acini can be coloured by maceration of the gland in a 5 per cent. solution of molybdate of ammonia, and subsequent treatment by a 40 per cent. solution of tannic acid, or a 20 per cent. solution of pyrogallic acid. The *membrana propria* of this and other glands may be isolated by maceration in weak soda-lye, which destroys the cells of the gland, but leaves for a time the membrane entire. It also colours yellow with iodine. V. A. Latham.

307.—Bread Fungus.—*Mylitta Australis* is called native bread in Australia, where it is largely used as food by the natives. This fungus frequently weighs as much as from one to three pounds. Other species nearly allied to it, are also used in China for food and as medicine. *(Bentley's "Botany.")* J. A. Hogg.

327.—Cultivation of Sundew.— Louden's "Encyclopædia of Gardening" states that *Drosera Rotundifolia* will thrive and flower well when kept in small pots in the greenhouse. "The pots should be filled three parts full of peat earth, and some moss placed on it, the *Drosera* then planted in the moss, and the pots placed in pans of water." I have never seen it under cultivation, but in its natural localities it is indeed a beautiful object. It grows in wild luxuriance in the marshy parts of the Island of Arran, notably near Glen Sannox, and nothing can exceed the beauty of these glittering plants when the sun shines on them, growing, as they do, thick and close as the daisies in an English meadow. J. A. Hogg.

330.—Salt.—Salt causes thirst by lessening the amount of urine, which is greatly diminished in quantity. Common salt is given off in sweat, readily soluble in urine, less soluble, especially potash, in the fæces. Thirst is caused by a sensation of heat and dryness of the tongue, mouth, and fauces, and indeed may be excited by inhaling dry air. More frequently, however, the sensa-

tion is the expression of a general condition indicating the diminution of water in the tissues ; or it may be to excess of saline matters in the blood. Salt increases consumption of water, and this in turn increases the transformation of nitrogen in the body. If an animal be deprived of salt, nutrition is interfered with ; deprival of common salt causes albuminuria. The salts, alkaline, serve to neutralise the sulphuric acid formed by the oxidation of the sulphur of the proteids. Salt plays a most prominent part in connection with the diffusion of fluids through membranes, and its presence is necessary for the solution of the globulins. V. A. L.

331.—Canada Balsam.—The advantages of using solutions of Canada balsam are, the facility and cleanliness of working, the ease with which air is expelled, and the opportunity of mounting objects in balsam which will not bear the slightest degree of heat. The best solvents are chloroform and benzole. Turpentine may be used, but does not give such a clear solution. An opacity occurring in liquid balsam mounts is generally due to moisture in the object, and may often be removed by gently warming the slide.

J. A. Hogg.

333.—Lobster.—If B. O. B. will read Dr. A. B. Griffiths's article in *Science Gossip*, pp. 57, vol. 22, 1886, on "The green gland of *Astacus fluviatilis*" (Cray-fish), he will find it very similar to the lobster, and will be able to understand the subject. See also Huxley's "Cray-fish," pp. 83 and 224, etc., Int. Science series.

V. A. L.

334.—Octopus.—Yes, the octopus (*Cephalopoda*) possesses odontophores or tongue-ribbons, the hinder part of which is furnished with recurved spines. See "Invertebrata," by Huxley, and Zoology by Claus and Sedgswick, or any Zoology. V. A. L.

337.—Drawing on Glass.—Grind lamp-black with gum water, and some common salt. Draw the design with a pen or hair pencil. V. A. L.

337.—Etching on Glass.—The objects to be etched are immersed in a bath of melted wax, which on removal forms a thin coating over their surface. On this the designs are carefully scratched out by means of a pointed instrument, which removes the wax along the lines of the pattern. The glass is then immersed in a solution of hydrofluoric acid, contained in a leaden vessel. The acid, which is very corrosive, attacks all the portions of the glass not protected by the wax, thus eating out the lines of the engraving on the glass. When this is done, all that remains is to clear away the wax. Owing to the destructive nature of hydrofluoric acid, a special room is kept, in which it is applied, the

windows of which must be coated with wax, and the vessels used to contain the acid must be made of lead. Monograms and similar designs are printed in a kind of thick ink, on transfer paper, the lines of the monogram being left uncovered by the ink. The pattern is then transferred to the glass, the ink protecting the portions covered from the acid in the subsequent processes. As, however, the monogram only covers a small portion of, say, a wine-glass, or decanter, the rest is coated with wax. The bath of hydrofluoric acid is then used as before.

The pretty zig-zag patterns which so frequently adorn many wine-glasses are scratched on the wax by means of several ingenious machines. One of the simplest patterns, which is a sort of "trochoidal curve," is produced by the tracing point rapidly revolving in a circle, while the glass slowly turns round on its axis. Another well-known pattern is traced out by a rather complicated mechanism, in which, by means of wheels having cogs along half their circumference, the tracing points are made to move up and down, and the glass to turn round, alternately, in a series of jerks.

Although most of the patterns on glass are etched in this way, they lack the sharpness of definition required for the very best engravings. These latter are therefore carefully ground by hand, very small rapidly-rotating wheels covered with fine rotten-stone powder being used to cut out the pattern on the glass. A large number of wheels of different shapes and sizes must be used for the various details of a complicated design, such as a bunch of flowers and fruit, and this method is only resorted to in the case of the most expensive dessert sets, as it involves a considerable amount of skilled workmanship.

With regard to the embossed patterns, so common on butter-dishes and similar articles, these, as well as the lenses used in lighthouses, are formed by pressing the molten glass into moulds of the desired form. The flutings and ribbings on decanters, and the familiar lozenge or diamond patterns on cruets, are carved on the glass by means of grindstones, whose edges are rounded, angular, or flat, as the case may be. In the preliminary grinding, rotten stone and water are used, but for the final polish the finest putty powder is required.

We are indebted to Messrs. Molyneux and Webb for their kindness in conducting us over their glass-works at Manchester, during the visit of the British Association, and in explaining the various processes which I have here attempted roughly to describe, as well as for a large amount of other information respecting the manufacture of glass. G. H. B.

350.—Penicillium Glaucum is familiar to everyone from its forming sage-green crusts upon bread, jam, boots, etc. Prepare some Pasteur's fluid, and leave exposed to the air in saucers in a

warm place, and blow a little *green* dust of common mould upon its surface, and leave for ten days or a fortnight. Or, if no mould is at hand, it will probably be covered with penicillium if left to itself. Sometimes, however, the fluid is overrun with bacteria, to the exclusion of everything else. By hardening the mould in alcohol, or by fixing with picric acid, and subsequently treating with staining reagents, the numerous nuclei may be seen. I treat as for ordinary preparations, and mount in glycerine. V. A. L.

351.—Intestine.—Float a piece of the mucous membrane, with the villi downwards, upon the surface of the chromic acid hardening solution. In this way the villi become erect and firm, and good sections of rows of villi may be obtained (Beale).

J. A. Hogg.

352.—Olfactory Mucous Membrane.—Harden the head of newt in Müller's fluid for 4 or 5 days. Snip out the upper part of the nostril. Scrape mucous membrane of the detached portion with scalpel point. Dissociate with needles, and preserve in Farrant. They may be stained in picro-carmine and mounted in glycerine. (2) Place fresh mucous membrane in dilute alcohol for an hour, then 5 minutes in osmic acid (1 per cent.) and then in water. This gives the cells more resistance. Scrape off the membrane, and separate in water of picro-carmine. (3) The superior turbinated bone, or upper part of the nasal septum, of a recently killed rabbit, place in chromic acid and spirit for a week; then in chromic and nitric acid until the thin bone is softened; wash in water, place in alcohol. Cut thin vertical sections and stain in logwood, mount in balsam or glycerine. (4) Take a fresh mouse's head; place in solution, as 3. When decalcified, wash and preserve in spirit. A transverse section should be made through the nose, cut perpendicularly to the plate of the palate. Stain with logwood and eosin, and mount in dammar. V. A. L.

355.—Mounting Starches.—The method described on p. 35 of this volume gives very satisfactory results. Davies recommends balsam thinned with turpentine. Cooke uses salicylate of soda. Dr. Muter, editor of *The Analyst*, finds that the granules retain their character longest by being mounted in a mixture of glycerine (1 part) and camphor water (2 parts). J. A. Hogg.

358.—Pollen.—Mix a little ripe pollen with some of the clear viscid fluid from the stigma. Put on a cover, and view with $\frac{1}{4}$ or $\frac{1}{8}$ o.g. The pollen-tube extends itself, while the whole contents of the cell are in motion. Pollen of lilies answers best. If "Botanic" desires to prepare stigmas, showing pollen-tubes, he will find full directions on p. 55 of the January number of *The Journal of Microscopy*. J. A. Hogg.

360.—Urinary Deposits.—It is desirable to have the whole quantity passed in the 24 hours. If, however, the presence or absence of any particular substance be all that is desired, then a few ounces will be sufficient. It should be examined within a few hours of its secretion, although a second examination is frequently important after the urine has been allowed to stand 18—24 hours. Pour 4—5 ozs. into a tall, cylindrical, glass vessel, and allow to remain for a sufficient time to allow any deposit to subside. This may be removed by means of a pipette. For the ordinary examination, it is generally convenient to place a drop of the urine on a slide with a shallow cell. The best cell consists of a rounded, shallow cavity, ground in the centre of the surface of the slide. One made of a thin ring of dammar varnish allowed to dry also answers the purpose. Deposits may be preserved in Canada balsam, glycerine, 1 per cent. solution of carbolic acid in equal parts of glycerine and camphor water, in a solution of naphtha and creosote, and in various other media. The naphtha and creosote fluid is prepared as follows :—(*a*) Creosote, 3 drms.; (*b*) naphtha, 6 ozs.; (*c*) distilled water, 64 ozs.; (*d*) prepared chalk, a sufficient quantity. Mix *a* and *b* together, then add of *c* sufficient to make a thin, pulpy mass; very gradually add *d*, keeping the mixture in motion with the pestle all the while. Place the whole, together with a few pieces of camphor, in a lightly-covered vessel for two or three weeks, occasionally shaking or stirring the mixture, then filter, and preserve in corked or stoppered bottles (Beale).

To Mount.—Let the sediment settle in a test-tube, when as much as possible of the urine is drawn off. Add about equal bulk of the preservative medium to the sediment, and shake well. Let it rest until the sediment settles to the bottom of the tube again. Draw off the preservative fluid, and add a fresh quantity of the fluid. By so doing, the deposit is thoroughly impregnated with the preservative medium. The *casts* are well preserved in this solution, but the paler ones should be coloured with carmine to show clearer. *Phosphate of lime* is preserved in the naphtha and creosote fluid. The *triple phosphate crystals* are best preserved in water to which a little chloride of ammonium has been added, or in strong ammonia (1 part) and water (6 parts). *Cystine* (a rare deposit), preserve in glycerine jelly or in the naphtha solution or in dilute acetic acid (ordinary pyroligneous acid, 1 part; water, 20 parts). *Urates* and uric acid, in weak spirit or glycerine solution, or in the naphtha. Crystals of uric acid show nicely, mounted in Canada balsam. First thoroughly wash in distilled water, and dry carefully under a bell jar, over H_2SO_4 (sulphuric acid). When dry, a drop of oil of turpentine is added, and allow to nearly evaporate, when a drop of Canada balsam is

added, and the slide gently warmed. Care must be taken that the heat is slight. Or mount in equal parts of glycerine and camphor water. Camphor water is prepared by wrapping 3 grms. of camphor in a piece of muslin, place it in a bottle containing 1500 c.c. of water, and shake repeatedly. The fluid is ready for use in three or four days. They may be mounted in glycerine jelly. Wash the deposit in weak spirit and heat the glycerine jelly till it is fluid. Place a drop on a warm slide, add the urinary deposit, and after a few seconds apply a warm cover-glass. When cold, scrape it away from the edge of the slide, seal with cement, and finish. Crystals of oxalate of lime and uric acid are well seen. They may also be mounted in the naphtha solution. Many may be preserved in the dry state best, such as urea, nitrate of urea, oxalate of urea, creatine, creatinine, and many others. They are allowed to form upon the glass slide, when they are thoroughly dried, under a bell jar, over sulphuric acid. Ring white zinc, or, better, brown cement, around the crystals, then apply cover, and hermetically seal.

Calcic phosphate is usually amorphous, but occurs sometimes in rosettes of crystals. These may readily be obtained by simply adding to urine a small piece of calcium chloride. The precipitate is allowed to form in a conical glass, and may be mounted and preserved in the mother liquid. Glycerine and distilled water, of each, 4 fluid drms.; chloral hydrate, 5 grs.; creosote, 5 drops; gum camphor, 2 grs. Mix, shake thoroughly, and filter. This is A. G. Field's method for casts, etc. For directions, see *Amer. M. Micro. J.*, Vol. VI. (1885), pp. 39 and 40. Hitchcock used dilute carbolic acid, with shellac, as the cement. V. A. L.

360.—Urinary Deposits.—Use a logwood dye, made by rubbing 5 grms. of extract of logwood with an equal quantity of alum, and adding 100 cc. of water. Let it stand twelve hours and filter. Allow the urine to deposit in a conical glass for some hours and then pour off as much as possible of the clear fluid. Add to what remains an equal bulk of the stain. In two or three days the tube, casts, etc., will be of a reddish purple colour. Mount in balsam or dammar. J. A. Hogg.

361.—Plants.—Plants live on the simple compounds of carbon, hydrogen, and nitrogen, given off by animals, building up out of them new complex substances which animals can use as food. A green plant, supplied with ammonia salts, carbon dioxide, water, and some minerals, will grow and build up large quantities of proteids, fats, starches, and similar things. To do such work needs a supply of kinetic energy, which disappears in the process, being stored away as potential energy in the new compound. We

ask whence it is that the plant gets the supply of energy it uses for chemical construction. It has been proved that the green plant uses the energy of sunlight. Exposed to air, it gets carbon dioxide, light, water, and ammonia from the soil. The plant builds them up again, giving off oxygen. V. A. L.

361.—Plants.—Green vegetation gives out oxygen, as chlorophyll has the property of decomposing carbonic acid during sunlight, but not in darkness. This giving out of oxygen and absorption of carbonic acid must be carefully distinguished from the process of respiration of plants, which only goes on to a very slight extent, and consists in taking in oxygen from the air and probably giving out carbonic acid. This process of respiration goes on continually both in light and darkness as it does with animals, but during sunlight it is largely masked by the process of nutrition, concerning which W. asks, and which consists in the plant taking in carbonic acid and giving out oxygen. This process is suspended during darkness, when the exhalation of carbonic acid is more readily observed than it is during the day-time. J. W. G.

363.—Explosion of Potassium.—In Watt's "Dictionary of Chemistry" it is stated:—"The Potassium obtained by this process is not pure, but always contaminated with compounds containing carbon and oxygen. To remove these, it must be distilled a second time in an iron retort, and this precaution is essential, as if the crude potassium is exposed to the air, and even if it is preserved under naphtha, a black detonating compound is quickly formed, which explodes violently on the slightest friction."

B. O. B.

364.—Divergent Series.—According to definition, a *divergent* series is one whose sum does *not* approach a finite and unique limit as the number of terms added up is continually increased, so that the "sum or value" spoken of by F. S. S. has no existence. In the case of the first series named (viz., $1-2+4-8+16\ldots$) the sum of n terms is $[1-(-2)^n] \div 3$. When n is made infinite, this becomes infinite, and is positive or negative according as n is odd or even. It is only when a series is *convergent* that we can speak of its having a sum, and this can never happen when the terms keep on increasing.

The series mentioned in the second query are known as *figurate numbers* of the third and fourth orders. The various orders are as follows:—

1st order	...	1, 1, 1, 1, 1.....
2nd order	...	1, 2, 3, 4, 5.....
3rd order	...	1, 3, 6, 10, 15.....
4th order	...	1, 4, 10, 20, 35.....
5th order	...	1, 5, 15, 35, 70.....

and so on. The successive orders are found by taking the sum of 1, 2, 3... terms of the preceding order, and therefore the difference between any term of such a series and the term before it is equal to the corresponding term of the preceding order. The general expression for the nth term of the mth order of figurate numbers is—

$$\frac{n\,(n+1)\,(n+2)\ldots\ldots(n+m-2)}{1.\ 2.\ 3\ldots\ldots\ldots\ldots\ldots\ldots(n-1)};$$

and is the same as the mth term of the nth order. It may also be noted that the figurate numbers of the mth order are the co-efficients in the expansion (by the binomial theorem) of $1 \div (1-x)^m$ in a series of ascending powers of x.

G. H. Bryan, B.A., Cambridge.

368.—Spathe.—A spathe is simply a large bract, and a bract is the name given by botanists to the leaves of the flower region of the stem. These are very varied in shape and position. Some are chaffy scales, as in the Grasses; others being quite leaf-like. In the Daffodil, Narcissus, and Flag, it is of a membranaceous texture; while in the Arum it is very largely developed, and takes the form of a sheath, which partly envelopes the reproductive organs. This is the true spathe, and is of a petaloid structure. In the Palms the spathe grows to an immense size, and resembles one of the leaves of the tree. As a general rule, the bracts are smaller than the leaves preceding them, are usually simple, and often mere scales. The bract at the base of the Snowdrop flower is one example.

H. W. Lett, M.A.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply All answers should reach us before the 12th of the month.

372.—Microscope.—I have intentions of purchasing a microscope, but not knowing much about the instrument, or the working of it, would like to ask any of your readers if they would be kind

enough to give me the benefit of their advice; whether I should purchase a single dissecting microscope, such as I see advertised by Aylward, of Manchester, or one by Henslow, at 15/-, and learn to work with the various fluids required, or should I purchase one at £3 10s. or £4, or a better one still, seeing not much is allowed for second-hand articles; and what is the difference among the various names, as scientist's, student's, histological, achromatic, and so on, or if by purchasing one at £4, or so, could the more expensive articles be fitted to it when I have more experience? This is a rather long question, but a few short answers would be gladly accepted from a practical man. R. C.

373.—Noctiluca Miliaris.—Has it been proved conclusively that Noctiluca possesses an anal orifice, and if so, by what authors? OCTOPUS.

374.—Eye of the Cat.—Are the muscles which control the contraction and retraction of the pupil voluntary or involuntary? B. E. M.

375.—Amputation of the Leg.—Will some of your readers, versed in physiology, explain how it is that the patient complains of pain in the limb when it is removed? C. E. B.

376.—Neophytes.—What are the most distinguishing characteristics to a neophyte in physiology between fossil wood and fossil bone, as in some geological formations they closely resemble each other? P. S. A.

377.—Crystals.—Can any one kindly inform me what are the uses of plant crystals and raphides in the cells of plants; those of oxalate of lime, for instance, in the root of the medicinal rhubarb? QUAERENS.

378.—Bleaching Skeleton.—Is there any way of improving the appearance of a skeleton which has become discoloured by age? P. W.

379.—Sections of Flower and Leaf Buds.—What is the best method of making sections of buds to demonstrate estivation and vernation? W.

380.—Freezing Microtome.—For what class of botanical objects can this microtome be used with advantage? W.

381.—Queen Bee.—I am told that although the queen bee has a sting, and ejects poison therewith, she neither can, nor does, inflict a wound with the sting, but may be handled by the most delicate fingers without danger of hurt. Can any reader tell me if they *know* such to be the case? B. C.

382.—Plant Hair.—I often wonder of what use to the plant are the hairs of plants. Some of them form most beautiful microscopic objects. S. F.

The Scientific Enquirer.

JULY, 1888.

A Short Sketch of the Ichneumons.

By G. H. Bryan, B.A.

Chapter I.

SETTING aside the Lepidoptera, it is certainly remarkable how little attention has been devoted to the study of insects in general in this country, whilst in consequence of the scarcity of collectors of such insects as Hymenoptera and Diptera there are considerable difficulties in the way of identifying species of these orders. Perhaps the Ichneumons are as troublesome to determine as any other group of insects, if not more so. The following sketch is intended merely as an introduction to the study of this large group of Hymenoptera.

Their numbers are so great that a mere list of the genera and species would occupy far more room than is at my disposal. I have therefore selected those species which best serve as examples of the different families, and have endeavoured to collect that information which may be most needed by anyone beginning to take up the study, in the hopes that some collectors, having plenty of time at their disposal, may do so.

The insects known collectively as Ichneumons belong to the *Hymenoptera terebrantia*, in which the females are provided with boring ovipositors, and are thus distinguished from the *Hymenoptera aculeata*, in which the ovipositor is modified into the form of a sting, and used as a weapon of defence.

There are two families to which the common name of Ichneumon is applied indiscriminately: the Braconidæ or Braconites, and the Ichneumonidæ or Ichneumonites, which latter family alone have a true claim to the appellation. In Germany, the true

Ichneumonites are termed "Schlupfwespen," the Braconites being "Schlupfwespenverwandte," or "relatives of the Ichneumons." With regard to the name Ichneumon, this appears to be derived from the name of an Egyptian animal which was parasitic on the crocodile. This creature, which has frequently been mentioned in the writings of the ancients, was famed for destroying mice and other animals, but appears to have had a great liking for poultry also. It is described as a reddish-grey animal, about 42 inches long, with short legs.

To return to our subject, the Ichneumons have generally more or less curly filiform antennæ, frequently with a broad belt round them. On the head, in addition to the two large compound eyes, are three simple eyes, or "ocelli." The mouth parts are essentially adapted for biting, the mandibles being large and powerful, while the labium and tongue are short.

The thorax is as usual divided into three parts: the prothorax, mesothorax, and metathorax. To the first are attached the front pair of legs, the second bears the fore wings and the second pair of legs, while the metathorax carries the hind wings and the third pair of legs. The wings are generally covered with spines, and in flight the hind wings are connected with the front ones by a row of fine hooklets along their anterior margin, which catch in a kind of groove along the hind margin of the fore-wings in the manner common to all Hymenoptera. The legs of ichneumons are long.

At the extremity of the abdomen will be seen a bristle-like appendage. This is the ovipositor. It consists of two sheaths and a terebra. This terebra again is formed of three pieces, and when these are united it forms a finely-pointed borer, down the centre of which the egg is allowed to pass. As will be gathered from the descriptions to follow, the length of this appendage is very variable; in some cases it is very great. As a rule, those ichneumons having long ovipositors attack horny insects.

The chief distinctive characteristic between the BRACONITES and ICHNEUMONITES is that the former have only one transversal nervure in the fore-wings. This nervure commences at the upper marginal cells, and runs across the wings. The ICHNEUMONITES, on the other hand, have two such nervures.

Of the BRACONITES, we may take as representative species *Microgaster glomeratus* and *Microgaster nemorum*, the larvæ of which live parasitically on the common cabbage white butterfly (*Pieris brassicæ*), and the silkworm respectively, the yellow cocoons of the former being frequently seen on cabbage caterpillars. This genus has a small sessile abdomen, antennæ large, 18-jointed; it is also distinguished by the form of its sub-marginal cell. This is the cell surrounded by nervures, and

adjacent to the anterior margin in the outer half of the wing. Now, the species of *Microgaster* have an irregular, hexagonal, or heptagonal, sub-marginal cell just beneath the dark spot in the anterior margin. In other genera there is also a triangular cell outside, which is here absent. Body bright black, the hinder edge of the first two segments of the abdomen being lighter; bases of wings covered with yellow hairs; legs, reddish yellow, with the exception of the hind pair and the tarsi of the others, which are black.

Our next example is taken from the typical genus of the group, of which two hundred species are found in Germany, and is known scientifically as *Bracon immutator*.

It is a very small insect, the entire length from head to tail being only three millimetres. The head and thorax are black, while the abdomen is reddish yellow, with a broad black band down the back, and the legs are reddish yellow, black at the base, and with brown extremities to the tarsi. The ovipositor exceeds the abdomen in length.

On the buds of oak trees, about June, will often be seen numbers of large, round galls, commonly called oak apples, yellowish in colour, and varying from the size of a cherry upwards. If one of these be cut open it will be found to be more or less spongy in texture, and to consist of numerous chambers containing the larvæ of a small insect belonging to the Cynipidæ, whose name is *Andricus terminalis*. Yet the *Bracon* spends its larval state in these galls, living parasitically upon the maggots inhabiting them. Other species of *Bracon* are parasitic upon the larvæ of beetles.

We now pass on to the second great group: the ICHNEUMONITES, or true Ichneumons, of which no less than 1190 kinds are known to inhabit Great Britain alone. According to Francis Walker's "Synopsis of the Ichneumonites,"* the European forms are classified under six families:—OPHIONIDÆ, TRYPHONIDÆ, BASSIDÆ, PIMPLIDÆ, CRYPTIDÆ, and ICHNEUMONIDÆ. Holmgren includes the genera, *Bassus* and *Metopius*, which according to Taschenberg† constitute the BASSIDÆ, in the TRYPHONIDÆ. On the other hand, many writers place the genera, *Exetastes*, *Banchus*, and *Scolobates*, in a separate family; the BANCHIDÆ distinguishing them from the OPHIONIDÆ by their sessile or sub-sessile abdomen, and this arrangement is followed

* Translation of synoptical arrangements of some European families and genera of Hymenoptera. (London: E. W. Janson, 27 Museum St. 1874. pp. 48.)

† Die Hymenoptern Deutschlands (Bremen: Verlag von M. Heinsius. Preis 4 M., 50 pf).

in the handy little German work on insects, by Von Schlechtendal and Dr. Wünsche.*

The first of these insects which we shall describe, *Ophion merdarius*, is a good example of the OPHIONIDÆ, in which family the abdomen is compressed on both sides, at least near its extremity, and invariably crescent-shaped. In the female the ovipositor is scarcely visible. The genus from which the group is named is characterised by the long pedicel, by which the abdomen is attached to the thorax, and is distinguished from *Paniscus* by the fact that the second sub-marginal cell is joined with the first. In all the Ichneumonites the first cell forms with the middle cell next below a large cell, so that sometimes, as in the species above mentioned, only the commencement of the dividing nervure is just distinguishable.

In the genus *Banchus*, the abdomen is broad at the base, distinctly flattened, and the scutellum tapers to a short point. In *Exetastes* the abdomen is rounder, flattened only at the extremity, where it forms a tail, containing the ovipositor in the female sex.

Paniscus is distinguished by triangular discal areolet. *P. glaucopterus* attacks the Willow Saw-fly (*Cimbex Saliceti*).

Anomalon circumflexum is in its larval state parasitic on the caterpillar of *Dasychira abietis*. Head and thorax, including the bases of the legs, black; antennæ, face, scutellum, and abdomen, yellow; legs reddish yellow; tip of abdomen and hind tibiæ and tarsi of the prevailing black colour. Wings short in proportion to the size of the insect, yellowish.

All the species of *Anomalon* have a short, transverse nervure, starting from the discal areolet.

[*To be continued.*]

The "Skunk Cabbage."

By MRS. ALICE BODINGTON.

ON the town site of Vancouver City, in British Columbia, there are many acres still unbuilt upon, and in April, on every marshy spot, are numbers of the above extraordinary misnamed plant. It is an arum, with a

* Die Insecten, eine Anleitung zur Kentniss derselben. (Leipzig: B. G. Teubner, 1879, 3 Vols., 15 Plates, pp. 707, Price 9 M., 60 pf.)

spathe of a very pretty pale yellow, in shape intermediate between our common field arum and the lovely hot-house plant of the same family. The uncoloured spathe of the field arum remains lightly coloured till it begins to fade; the snowy spathe of the exotic arum is not only closed, but takes a beautiful backward curve. In the "skunk cabbage" the spathe opens so as fully to display the spadix, but always retains its inward curve.

The common arum (*Arum maculatum*) of our fields is, as all botanists know, fertilised by small insects, which are imprisoned by a *chevaux-de-frise* of down-turned hairs till the spathe fades and lets them escape; the male and female flowers are in separate rows, the female (I believe) being in the lower row. I have been quite unable to perceive any insects, small or large, visiting the Skunk Cabbage. I conclude that it is fertilised by the wind; the pollen flies in clouds at the slightest touch of the plant, as may usually be noticed in anemophilous flowers. There are evidently elaborate arrangements to secure cross fertilisation; in fact I was at first under the impression that this arum was diœcious. At an early stage, when the spathe first opens, the spadix is green, and is covered with closely-fitting little green rosettes of four flat petals, with the pistil standing conspicuously in the centre, the viscous secretion on the stigma appearing like a minute dew-drop. There is not the slightest sign of stamens at this stage. I picked several arums in this condition, all alike, green, and without a sign of stamens. Then I picked other flowers which were conspicuously different. They were evidently at a more advanced age; the spathe was well opened and of a beautiful yellow, the spadix also yellow. The spadix of some of these was covered with flowers having two stamens, but no sign of a pistil. I examined others still older, and found four stamens with anthers dehiscing ventrally, and forming a cup, below which, low down, one could see the pistil. One stamen, usually the lower one, never a top one, was enormously developed in some cases. Of course, I perceived the plant was not diœcious, and I again examined the green spadix with its pistil and four flat petals. I carefully raised the petals, which adhered so closely that it was difficult not to break it in trying to raise them, and under each lying the stamens. In the next stage two stamens rise and meet at the top so as to conceal the pistils; in the last stage of flowering the four stamens stand round the greatly depressed pistil, superficially resembling the tubal flower of the Compositæ.

The leaves are large and sheathing, resembling, in their glossy and beautiful green tint, the leaves of our common arum. The plant has a very unpleasant smell; hence, no doubt, it received a name so unpleasant to ears polite.

Short Papers and Notes.

The Development of the Chick.

AT a recent meeting of the Leeds Naturalists' Club and Scientific Association, an embryological subject engaged the attention of the club, under the direction and guidance of the President (Professor Miall, F.G.S.), viz., the "Development of the Chick." The subject was treated from an elementary point of view, and was illustrated by diagrams on the black-board, and afterwards by the examination and dissection of chick embryos in various stages of development. The egg was shown to consist externally of the shell, lined by shell membrane; then the white; and lastly the yolk, which was contained in a delicate membranous sac. The shell membrane is double at the broad end, and encloses an air-space. This space does not, however, exist in new-laid eggs, but its formation commences soon afterwards. The yolk is anchored at opposite poles by thick twisted bands, called chalazæ. The ovary produces the yolk only, and the white is secreted as it passes down the oviduct. The motion is of a spiral nature, and thus the white is laid round the yolk in twisted or spiral bands. The yolk is not uniform in density; one part, that from which the future embryo is developed, usually called the "white yolk," is lighter, and therefore always forms the upper surface of the yolk. The yolk, again, is lighter than the semi-fluid white, and floats in it in close proximity to the upper part of the shell, and in whatever position the egg lies, and however often its position is changed the white yolk is thus placed so as to receive the greatest amount of heat from the body of the hen. As the chick develops, the chalazæ secure it, and prevent injury from friction between the yolk and the white.

From this point the demonstration was of a practical character on partially incubated eggs. The President showed that the egg should be opened for such purposes by pricking the broader end of the shell, so that when the upper surface is penetrated the weight of the shell contents drives out the air contained between the two layers of shell membrane at the broad end and leaves a space beneath the upper surface, so enabling the operator to remove the shell without injury to the embryo. The shell is then cut through equatorially by strong scissors, the operation being conducted in a slightly saline solution heated to 41° C. The embryo, being lightest, then floats to the top, and may be removed in a watch glass or on a cover from the yolk sac by dissection.

The embryo, if sufficiently large for sectionising, is hardened in picric acid (Kleinenberg's formula). A three days' embryo cannot be thus dealt with, but should be treated with a 1 per cent. solution of osmic acid. In a few minutes the preparation is sufficiently dry to cause adhesion to the cover. This readily permits the examination of the embryo, which is protected from drying by the amniotic membrane and its contained fluid, and its outline is thus clearly distinguishable. The next stage is immersion in Müller's fluid for 24 hours, which prevents curling when afterwards transferred to Kleinenberg's fluid to harden. The final stages are treatment with alcohol of various degrees of strength to remove water, clearing with oil of cloves, which removes the alcohol, and the preparation is finally mounted in Canada balsam.—*Leeds Mercury.*

Frail Animal Life.

One summer day I took a few eggs of the common "horn-pout," or "cat-fish" (*P. atrarius*), from under a board in the creek and put them in a small dish of water. They had probably just been deposited there, as there was a fish with them. Each egg consisted of a small yellow part, surrounded by a semi-transparent part of a whitish colour; in a short time a small white spot made its appearance in the centre of the yellow part. It grew larger and soon two eyes began to develop in the white spot, and later a small stream of blood began to pass from the lower part, upward, toward the eyes, and passing, drop by drop, disappeared under the now large, head-shaped portion that contained the eyes. This white part, gradually assuming a darker colour, began to protrude and shape itself more and more until it extended some distance from the yellow part. While the head was thus growing, a tail was making its appearance, and extending in an opposite direction from the head. The egg was now growing smaller while the fish rapidly increased in size. The blood in the small artery was now flowing along the back and disappearing in the head; it was truly wonderful to see this small stream of bright red blood going on its way, drop by drop, without any visible cause.

The fish (or egg) soon began to show signs of active life, wriggling and trying to move itself and its burden of egg food. The white, semi-transparent part was now rapidly absorbed, and the fish grew with astonishing rapidity, and could soon move about by jerks. It would make a great effort and move several times its length, when it would remain quiet for some time. No fins had as yet appeared, and it still carried a yellow sack about as large as itself. It was just learning to swim when the dish was upset and observations brought to an end, much after the manner of a chapter in a continued story.—*J. O. Snyder, in West American Scientist.*

Chemical Experiments.

The *National Educator* gives the following three curious experiments, which may not be new to the professional chemist, but will be of interest to the student in chemistry :—

To Light a Lamp with a Snow-ball.—When a small piece of potassium, the size of half a grain of corn (Indian corn or maize), is dropped into a tumblerful of water, some of the oxygen of the water leaves the hydrogen, owing to the intense heat which the chemical action produces, and combines with the metallic potassium, causing a bluish flame. When a piece of potassium is placed on the wick of a coal-oil, or alcohol lamp, the flame produced by touching the potassium with a bit of snow or ice or a drop of water will inflame it.

Fire under water can be produced by placing a small piece of phosphorus in a conically-shaped glass filled with water, and some crystals of chlorate of potash covering the phosphorus, and then pouring through a long tube funnel, or a glass tube, a few drops of sulphuric acid down on the mixture at the bottom of the glass. Tongues of flame can be seen flashing up through the water. The intense chemical action produces sufficient heat to inflame the phosphorus under water. When there is sufficient heat and oxygen, fire will burn whether in air or water.

The force of steam-boiler explosions can be illustrated by getting a tube made by a tinsmith, say, half an inch in diameter, and closed at one end. Put a piece of ice the size of a cherry, or half a tea-spoonful of water, into the tube and cork the open end tightly. Suspend the tube over a flame, so that the ice melts and is converted into steam. The cork will be forced out with a loud explosion. Water will produce 1,700 times its volume of steam.

Photographic Notes.

A Mucilage for Mounting Prints.—Mr. C. A. Parker gives the following for an excellent mucilage for those who always like to have on hand a ready means of mounting their prints :—Reduce to fine powder, in a mortar, one ounce of very pure gum arabic, and add to it three ounces of dextrine, and two fluid ounces of water, so as to form a thick paste. Dilute to five ounces, and boil over a water-bath for fifteen minutes, stirring continually ; add a little ammonia ; this composition may be kept for a long time.—*The Philadelphia Photographer.*

Mounting a Photograph.—The usually difficult operation of mounting a large photograph has now been greatly simplified by a French artist. For this purpose he provides a large flat box of the size of the cardboard, and on the bottom of which the cardboard is laid; a kind of frame on hinges, joined to the box in the form of a lid, is now closed, and fastened down to the box by means of hooks; this frame or lid having an opening in the centre a quarter of an inch each way larger than the proof or print to be pasted. The box is only about one inch high, and on the bottom is placed a piece of wood about half an inch thick, bevelled off towards the four sides, and of the exact size of the print to be pasted. In the centre of the bottom of the box is fastened a large screw, so as to raise or fall the piece of bevelled wood. Now the Bristol board is placed in the box, the lid of which is closed, the screw is turned, the centre of the Bristol board is pressed up the hole in the lid, and the pasted proof is taken and placed on the Bristol board, the square hole serving at the same time as a guide. The quarter of an inch given to the opening on each side allows the proof to be taken by the fingers and placed in its proper position with the greatest ease. It appears that this simple bulging-out of the middle of the cardboard before pasting on the proof, gives perfect flatness to the whole when dry.—*Germantown Telegraph.*

New Blue Print Formula.—The preservation of the ammonium citrate of iron solution in the formula generally used is often a troublesome matter, when larger quantities are made up than can be applied and printed immediately. I have recently found a remedy for the difficulty by the addition of boracic acid.

The following is the new formula:—

a.—Citrate of iron and ammonium ...	2 oz.
Boracic acid	10 gr.
Water (pure)	4 oz.
b.—Ferricyanide of potassium ...	1 oz.
Water	4 oz.

To use, mix in equal quantities and apply as usual.

A few additional notes may be of interest to amateurs. Paper may be safely coated in any ordinary lighted room, and spread about; care being taken that it is perfectly dry before being put away. If linen or unsized paper is used, the addition of gum is beneficial, but it should not be employed on a sized paper, as the sizing sufficiently accomplishes the same object. Where warm water can be had, the washing of prints is greatly facilitated. The addition of boracic acid gives a lighter print while still wet from washing, but becomes a brilliant blue if properly done. It must also be remembered that it takes a fine negative to give a fine blue print.—S. P. Watt, Columbus, O., in *the Philadelphia Photographer.*

Practical Hints.

Gardeners Labels for Plants.—A simple and durable label on light-coloured wood is obtained by varnishing the wood with a transparent varnish, and while the varnish is yet soft, writing the label with a lead pencil; the moist varnish fills in over the writing, and makes the label as permanent as the varnish itself.

To Perforate Earthenware.—A method which is said to be very satisfactory is recommended by Professor Stuart, as follows :— Instead of a drill a soft copper rod or pipe is used in the lathe, it being fed with a mixture of powdered emery and linseed oil. The emery is embedded in the copper by the friction, and cuts right through the hardest material in a very short time.

Glue, Paste, or Mucilage.—Lehner publishes the following formula for making liquid glue or paste from starch and acid :— Put 5 pounds of potato starch to 6 pounds of water, and add $\frac{1}{4}$ pound pure nitric acid. Keep it in a warm place, stirring frequently, for forty-eight hours. Then boil the mixture till it forms a thick and translucent substance. Dilute with water if necessary, and filter through a thick cloth. At the same time another paste is made from sugar and gum arabic. Dissolve 5 pounds of gum arabic and 1 pound of sugar in 5 pounds of water, and add 1 ounce of nitric acid and heat to boiling. Then mix the above with the starch paste. The resultant paste is liquid, does not mould, and dries on paper with a gloss. It is useful for labels, wrappers, and fine bookbinder's use. Dry packet glue is made from 12 parts of glue and 5 parts of sugar. The glue is boiled until entirely dissolved, the sugar dissolved in hot glue, and the mass evaporated until it hardens on cooling. The hard substance dissolves rapidly in lukewarm water, and is an excellent glue for use on paper.

Solubility of India Rubber.—Hanansek finds that 100 parts of oil of turpentine or benzole (not benzoline) dissolves $4\frac{1}{2}$ parts ceara, 5 parts of negro head, or 4·7 parts of Sierra Leone rubber. *Rundschau Leitmeritz.*

To Split Paper.—This is a very delicate operation and requires care. Paper can be split by gumming or pasting it on both sides, and placing between two perfectly flat glass plates of glass. When dry force the plates apart gently, and the paper will, if of decent substance, split, and with care each side can be removed from the glass by floating the plates in water; the pieces may be transferred to a book. A good deal of practice is required to make sure of splitting the paper accurately. The method is generally adopted in the case of printed engravings backed with type-printing, where it is desired to remove the letterpress and preserve the engraving.

Answers to Queries.

252.—Pineal Gland.—The pineal gland is a small gland, situated in the higher vertebrates, at the lower surface of the brain. It was a standing puzzle to anatomists, as its function was absolutely unknown. Feeling they must assign some use to this mysterious appendage, some wise men declared it must be the seat of the soul. In the lower vertebrates, such as reptiles and amphibia, the cerebral lobes do not cover the pineal gland, and it is just under the parietal suture—viz., that portion of the skull where the cranial bones are not completely closed in new-born children. A German and an English scientist, working independently, found that in the two species of lizards they were examining (Hatteria and Varanas), the pineal gland was connected with a perfectly formed eye in fact that it was an *optic lobe.* This eye is provided with a richly branched blood-vessel and nerves, and has its lens and layer of rods and cones of the retina, and in Varanus there is a modified transparent scale to act as a cornea. In embryonic amphibians the eye is still connected with the pineal nerve, but in adult frogs and toads the nerve strands become atrophied. But in the amphibia the pineal eye is found just *outside* the skull, pointing to a greater functional development in some remote ancestors than obtains in the reptilia. In point of fact, in the Labyrinthodonts the parietal opening in the skull was very large, showing roughness for the attachment of muscles, and pointing to the conclusion that the pineal eye was functional in these animals, and that it was "pre-eminently a sense organ of pre-tertiary periods."

The pineal eye is of *invertebrate* type, and thereby carries one back to an antiquity, in which the Labyrinthodont seems but a creature of yesterday. A. Bodington, Vancouver.

337.—Etching on Glass.—There are three ways of doing this: (1) With hydrofluoric acid. Solution commonly called fluoric acid. (2) With hydrofluoric acid vapour. (3) With the sand-blast. Methods Nos. 1 and 2 require the article to be previously coated with either wax or a mixture of wax and Brunswick black dissolved in turpentine. This having been allowed to set, the design is etched through the wax with a needle or graver, or if the design be one requiring large spaces to be etched, it is preferable to cover the glass only over those parts with the wax, etc., which are not required to be attacked by the acid. Having thus prepared the glass, cover it with a solution of hydrofluoric acid, taking the precaution to keep all clear spaces well covered with the liquid, which can easily be done by means of a large camel's-hair

brush. The strong acid must on no account be allowed to come in contact with the skin, as it is very likely to cause painful sores.

For process No. 2 you require powdered fluor spar and sulphuric acid, also a leaden dish of the proper size and shape, to correspond with the article requiring to be etched. In the dish, place the fluor spar, and across it arrange small lead strips to support the article. All being ready, pour in the sulphuric acid so as to well cover the fluor spar; place the whole in a warm place (but not hot enough to make the wax soft) for a short time, and when the glass is etched deeply enough remove the wax with warm turpentine on flannel. In some cases, it is possible to dispense with the lead dish by applying the mixture of spar and sulphuric acid directly to the article.

It is also possible to write words on glass by mixing hydrofluoric acid with gum, so as to be able to write with a quill pen, and then after some hours wash off the gum with water. The sand-blast requires special machinery, whereby a jet of sand is powerfully projected on to the article which has been previously coated with paper lace, or any like substance, over those parts not intended to be etched. J. W. G.

352.—Olfactory Mucous Membrane.—In order to get a good idea of the olfactory region, it would be advisable to make preparations both of the olfactory epithelium, and also of the entire nasal region.

The true olfactory cells in a Frog or Newt may be demonstrated by the simple method of slitting up the nostrils with scissors, and subjecting the entire head to the action of dilute alcohol for, say, 24 hours, then staining the still entire head in picro-carmine, and teasing out some of the epithelium from the olfactory region in a drop of glycerine.

Good preparations of the olfactory epithelium of Mammals may be obtained in the following way:—Procure the head of a *freshly-killed* Sheep, Rabbit, or other animal, and divide it, in its long axis, with a sharp saw, parallel to the nasal septum. Cut out the nasal septum so as to expose the olfactory region, the brown colour of which renders it easily recognisable. Harden this in Müller's fluid for two days, and then transfer to Chromic Acid and Spirit mixture for a week, and complete the hardening in weak, and then in strong, spirit. Vertical sections may be stained in logwood, or double-stained with logwood and picro-carmine, and mounted in dammar or Farrant.

Tranverse sections of the whole nasal chamber are highly instructive, as showing the relations of the various structures to one another. The head of an animal, such as Rabbit, should be injected from the aorta with carmine or Prussian blue, and after this operation the skull should be opened, and the brain carefully

removed. This being done, disarticulate the lower jaw, and cut off the head, placing the latter in Müller's fluid for 3 or 4 days, when it should be transferred to chromic acid and spirit mixture for the same length of time.

The next step is to decalcify the bones, and to do this the specimen should be subjected to the action of chromic acid and nitric acid mixture until the bones are soft and flexible, when sections of the entire nasal chamber may be made in a freezing microtome in the usual way. The sections may be doubly stained with logwood and iodine green and mounted in dammar. The head of a Frog or Newt may, with advantage, be treated in a similar manner.

The above methods are those recommended by Stirling in his "Practical Histology," and I think H. A. Parker will find them good and reliable. F. R. Rowley, Leicester.

353.—Ear, Human.—This is a very difficult organ to prepare; a properly-prepared cochlea yields very few good sections. The semi-circular canals are best obtained from a skate, whose cartilaginous cranium should be cut away until the canals, with their saccule and utricle, are exposed. The canals are hardened in chromic acid and spirit-mixture for a week, then transferred to spirit. The ampullæ receive nerves, and may be hardened in osmic acid. Sections of these canals must be made with a freezing microtome after steeping in syrup and gum. For the cochlea, kill a guinea-pig and disarticulate the lower jaw, when the osseous tympanic bulla is exposed. This lies just behind the fossa for the condyle of the lower jaw. Cut away the external auditory meatus, remove petrous portion of the temporal bone with the bulla from other skull-bones. Open the bulla with bone forceps, when a conical elevation—the cochlea—is seen. Remove all the surrounding bone and isolate the cochlea. Place at once in Müller's fluid for a fortnight. Then transfer to chromic and nitric acid or a solution of picric acid. Shake the fluid from time to time to facilitate the softening. After this preserve, first, in weak and then transfer to strong spirit. To make sections, first steep in water, to get rid of the spirit, and then it is subjected to the syrup and gum process. Make sections parallel with the mediolus—*i.e.*, across the turns of the cochlea, in a freezing microtome. Great care must be used, and stain in logwood or picro-carmine, and mount in glycerine. If a human cochlea, obtain fresh as possible. Cut out part of the temporal bone containing the cochlea. Split up in the axis of the meatus auditorius intermis; this gives two pieces of bone, one containing the cochlea and a part of the vestibule, the other the semi-circular canals and part of the vestibule. Place at once in Müller's fluid (3 parts) and spirit (1 part) for three weeks. Transfer them to a $\frac{1}{4}$ per cent. solution of

chromic acid for fourteen days. Then add a few drops of hydrochloric acid to the fluid to soften the bone. The bone around the labyrinth is very dense, and requires a longer time than the other parts to become soft. Wash thoroughly for 12 hours in water; place for 36 hours in syrup and 48 hours in gum; then freeze in gum in a freezing microtome. (See also Dr. Urban Pritchard's method.) V. A. L.

355.—Starches.—Breathe on the slide, and when it has evaporated it is not advisable at once to drop on the dammar, but, first placing over the starch a clean cover-glass, put at each edge of the cover, but not exactly opposite, a drop of dammar, which, running under the cover from each side, will imprison the object. If the dammar wave does not appear to travel freely, a little movement with a needle at the edge not touched by the medium will accomplish the purpose, and the slide may then be put away to dry, but, in this case, it is not well to put the starches in a warm place. It is a good way for mounting pollens, fern-spores, etc. This is mostly for polariscope. For ordinary mounting, Farrant or glycerine is recommended. (See *Science Gossip*, 1881, pp. 88—135 and 160.) V. A. L.

359.—Thorax.—Full instructions will be found in *The Journal of Microscopy and Natural Science*, Vol. 2, October, 1883, under the head of Microscopical Research in the Zoological Station at Naples, but if "Histo." cannot obtain this, the operations may be briefly summed up as follows:—Harden in successive strengths of alcohol, 10, 20, 30, 40, &c., per cent, ending with absolute alcohol. I find that everything depends on this being really absolute and not one or two per cent. below. Each stage to take 12 hours or longer. Next place in oil of cloves; then in oil of cloves containing a little soft paraffin; next keep warm in a drop of soft paraffin, melting point 40° C. for some hours. Temperature must not rise higher than 45° on any account. Allow to cool, imbed in hard paraffin, and cut. Stain if requisite and mount in fluid balsam. J. W. G.

367.—Sun putting out the Fire.—If Captain Cuttle will perform a few simple experiments, with his usual cuteness, he will soon find that sun alone will not put out the fire, but that sun and neglect will do so. If the sun shines into a fire, the latter is apparently much diminished in intensity, but only on account of the comparatively feeble light from the fire being masked by the more intense light of the sun. The flame is there still, and the fire is there although it cannot be seen. Two things are necessary in order to have a fire; first, a supply of fuel; second, a supply of oxygen at a sufficiently high temperature.

When the sun shines in a room the fire is generally neglected, and by the accumulation of ashes over the fuel proper, combustion

is retarded, and ultimately the fire becomes extinguished, not on account of the direct action of the sun, but because the oxygen of the air cannot properly combine with the carbon and hydrogen of the fuel. If the sun had the power to put out the fire, then a Bunsen burner must be extinguished in full sunlight. This is not the case, although the flame is absolutely invisible. It will still burn, boil, or bake, any article placed in it, and indeed in all respects act as an ordinary flame except in the matter of its invisibility. J. W. G.

[Will some other correspondent also answer this query?—*Editor.*]

368.—Spathe.—B. O. B. is much obliged to W. A. Lett for his answer to this question, but at the same time wishes to point out that the definition given:—namely, a Spathe, is a large bract—involves too much. By this definition any *large bract* would be properly termed spathe. As, for example, the glumes of grasses, the large bracts of the Atripler, the red bracts of the Pointsettia, many other Euphorbiaceæ, together with numerous other examples, which perhaps would illustrate the point far better. Many of these may be doubtful cases, but some of them no botanist could think of calling spathes. My difficulty was this—Gray defines a spathe as "a large bract or a pair of bracts *enclosing a flower cluster.*" Thomé says a spathe is the enveloping bract of a spadix; many other botanists defining it in the same way, indeed, some reasoning in a circle say that a spadix is a cluster of flowers, enveloped by a spathe, and that a spathe is the enveloping bract of the spadix. Hooker again terms the enveloping bract of the snowdrop a spathe, and as a snowdrop is neither a spadi nor a flower cluster, it appears to me that a more rigid definition of "spathe" is requisite. Mr. Lett's is too broad for scientific purposes, and many others are too vague. B. O. B.

368.—Spathe.—A large coloured bract, enclosing the inflorescence, as in the Trumpet Lily, is called a spathe (Lat., spatha, a spatula, etc.) A flower spike of this kind, enclosed in a spathe, is distinguished as a spadix—*e.g.*, Arum and Richardia. V. A. L.

370.—To Increase Specific Gravity.—A solution of ammonia, s.g. 884, contains, according to Carius, 36 per cent. of ammonia gas at 14° C., and a solution of s.g., 8911 contains 32·8 p.c. of ammonia gas. Other observers give somewhat different results. A table in Attfield's chemistry gives 38·118 and 34·4 respectively, being in the one case a difference of 3·2 and in the other a difference of 3·7 per cent.

I cannot find any table except Dalton's giving the strength of 880 ammonia, and as he gives this as 27·3 per cent he is probably wrong. Reasoning from Carius the s.g. of 880 would contain 38·8

per cent. of Ammonia, so that if these figures be correct, that amount of 880 ammonia must be taken to contain 32·8 parts of ammonia, and this be diluted to 100 parts. To do this, take 845 parts by measure of the strong solution, and dilute to 100 parts, or 845 parts, and dilute to 1000. J. W. G.

371.—Lithium.—Zinc and copper enter into the composition of plants growing near metallic mines, as in *Thalspi alpestre*, var. *calaminare;* Titaniums and bluminium are constituents of the ash of certain species of Lycopodium, cobalt nickel, strontium, and barium have also been met with in exceptional cases, and are the non-essential or accidental ingredients. V. A. L.

371.—Plant Constituents.—Lead, nickel, cobalt, tin, etc., are found in the ash of plants growing in soils containing these minerals. Lead and arsenic have been found in the ash of grasses grown in the neighbourhood of lead works. It is, however, pretty certain that the minerals thus obtained were not actual constituents of the plant, but merely attached to the surface in the form of minute dust.

Some of the other minerals found occasionally in plants are probably present in the same form, as, for example, cobalt, nickel, tin, and zinc. Cæsium was found by Sonstadt in seaweed, as well as Strontium, the latter in minute and doubtful traces. Copper is frequently found in wheat and other cereals, as well as in seaweed and hay, indeed Odling and Dupré, (Guy's Hospital reports, 1858,) state that small quantities of copper are constantly found in "flour, straw, hay, meat, eggs, and cheese," Zinc is found in the ash of a species of violet, *Viola calaminaria*, which grows on the rubbish heaps at calamine mines in Rhenish Prussia. Barium has been found in the ash of wheat grown in Nile mud, which contains a distinct per centage of barium carbonate. J. W. G.

372.—Microscopes.—R. C. should if possible get a friend to choose an instrument for him if he can. To work with a dissecting microscope would be most injurious to his eyesight, except for what its name applies. A microscope by Leitz and Co, £3 3s. (upright stand and immovable is its objection), is a very good and cheap instrument. Beck's Star, Aylward's Small College, and Swift's Students, are all good, and to these, at any time, may be added objectives and other apparatus, which is much the best way, and saves expense and getting a number of useless articles which may never be used. Smith "How to Use a Microscope," 1s. Pamphlet by Crouch, *Journal of Postal Society*, Vol. iv., 1885, p. 22. "How to Use the Micros," *Gage* on "Microscopical Technology," (U.S) Frank L. James, Elementary Micros. Technology.

V. A. Latham.

372.—Microscope.—By all means get a good stand with Society's Standard screw to start with; this with one eye piece and 1″ and ½″ objectives can be had for £4 or £5 from the best makers. Then, when experience is gained, more expensive and higher powers can be added. If R. C. will write to me, through our worthy editor, I can give him the full results of my experience in buying a microscope. I bought mine at £20, to start with, from a well known maker, who supplied it with a ¼″ objective that was quite useless, and which he promised to change, and did so *after four years had passed.* Had I now to go over the same ground, I would buy one of the new-pattern foreign instruments, with a much shorter tube than the ordinary English make. Having recently had the pleasure of working with one of these, I can testify to its extreme convenience and suitability to every purpose required by those whose studies necessitate the use of no higher power than ⅛″. H. W. Lett, M.A.

373.—Noctiluca Miliaris.—I cannot recall to mind any article which gives a notice of the anal orifice specially. The chief writer, I believe on this monad is Cienkowski, and of those found on the U.S. coast, Mr. E. Bicknell. I believe the only outlet from the œsophagus, which passes into the digestive cavity, is an oval nucleus which lies in front, and represents the anal orifice. A network of granular fibres arises from the granular layer; these fibres pass into the middle of the body to the nucleus and digestive cavity. I would refer B. O. B. to F. Ritter v. Stein, in Part III. of his "Organisms der Infusions," abth. III., Hälfte II., in which he discusses the Noctilucidæ, Ptychodiscus, etc., and mentions that in addition to a mouth-opening there is another opening which is analogous to an anus. See also Clans and Sedgewick; Huxley, "Invertebra;" and Rolleston, *Quarterly Journal Microscopical Science.* V. A. L.

374.—Eye of Cat.—The muscles of iris are *in*voluntary, sphincter and dilators; and the ciliary muscle consists of unstriped muscle. V. A. L.

375.—Amputation of the Leg.—The mind refers the origin of every sensation that reaches it through a sensory fibre, to the end organ of that fibre, even though stimulation has been applied to the trunk of the nerve. Thus, persons whose arms or legs have been amputated often feel sensations, which they refer to their fingers or toes. Any stimulation of the optic nerve, mechanical or electrical, the mind refers to the action of light upon the retina. See Wein Mitchell on Nerve Phantoms, Lipincott's Magazine, and Injuries and Diseases of Nerves, for a better and more complete explanation. V. A. Latham.

377.—Plant Crystals.—Notwithstanding the researches of numbers of botanists, the use of plant crystals, whether raphides,

sphæraphides, or crystal prisms, has not yet been discovered. Some consider them as aggregations of waste, a kind of excreta. That they do not strengthen the stem of the plant in which they are produced is evident, by the extremely brittle nature of those which furnish them in great quantity, such as the Cactus tribe.

H. W. Lett, M.A.

377.—Crystals are formed from the cell sap either in the cavity or wall of the cell. They consist of calcium phosphate, but generally of calcium oxalate, the latter salt being of two different forms. When the calcium oxalate crystallises with 6 equivalents of water, prisms and octohedra belonging to the dimetric system are formed; when only with two equivalents of water, then in raphides or needle-like crystals, belonging to the monoclinic system. The calcium oxalate is a secondary product of metastasis, the excess of calcium taken up from the soil being thus got rid of. The elements existing in the ash of plants are present only in very small quantities, but are essential to their lives. The sulphur is obtained from salts occurring in the soil, such as calcic sulphate, part of the lime being got rid of by the formation of crystals of calcic oxalate in the cells of diciduous and other parts of plants.

V. A. L.

378.—Bleaching Skeleton.—By well soaking in benzine and then in water in the sun, or by burying in white shore sand in the sun, or place in the oven till well heated. A solution of chloride of lime may be used also. Try steeping a little cotton wool in a liquid made of equal parts of water and alcohol, and rubbing some on the bones. If not sufficient then try with a solution of 1 part of chloride of lime in 4 parts of water. V. A. L.

380.—Freezing Microtome.—Sections of ovaries, petals, thin leaves, and slender stems, such as those of mosses, can be most advantageously made by means of a Freezing Microtome. I use one of Cathcart's for the purpose and find it all that could be desired. H. W. Lett, M.A.

381.—Queen Bee.—I have been a bee-keeper for close on forty years, and every summer handle many Queen Bees, sometimes holding them in my lips for a few seconds while my hands are busy, and I have never been stung by one. There is not the least doubt that her winged majesty can sting, for it is by the use of her sting she gets rid of a rival. The sting of the Queen differs from that of the worker bees in being slightly curved, the weapon of the latter being quite straight. H. W. Lett, M.A.

382.—Plant Hair.—It will be noticed that generally speaking plant hairs are more frequently found on the under than on the upper surface of the leaf. When the leaf is young and tender, it

would seem from the modes of æstivation that the upper surface of the leaf is usually protected from radiation by two surfaces being brought into approximation with each other. This necessarily leaves the under surface, or a portion of it, more or less exposed. It must also be remembered that radiation of heat from any surface is materially checked, and cooling prevented by any slight surface covering, which has the power of reflecting back the heat which otherwise would be given off.

It will thus be seen that the young plant hairs, which so frequently form a downy covering to buds and young leaves, act as an efficient protection to cold produced by radiation. Vegetation is not injured so much by the absolute coolness of the night air, as by the loss of heat from the surface of the vegetable itself by the radiation with space, and consequent chilling of the delicate growing vegetable structure, and it is this species of cooling which the plant hairs prevent. To answer this question fully one ought also to discuss the uses of stings, prickles, spines, tomentose, hairs, etc., which are evidently designed as protective agencies in other ways. J. W. G.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question or answer is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply. All answers should be sent to the Editor, 1 Cambridge Place, Bath, and must reach him before the 12th of the month.

383.—Toads.—How is it toads swallow live bees? Do the toads paralyse the bees by gazing at them first, or is the bee so astonished at being flipped up by the toad's tongue that she has not time to sting? S. A.

384.—Hairs of Urticæ.—How is it that the stinging hairs of Urticæ do not appear to sting the black caterpillars that are found in large numbers in some seasons on the nettle, and what is the name of this caterpillar visitor? B. N.

385.—Fungus Growth.—What is the name of the fungus growth that appears in the form of red points, about the size of a small pin's head, on the bark of many trees? W. J. S.

386.—Hens.—John Parkinson says, in his "*Theatrum Botanicum*":—"If you give hennes some dry nettles, broken small, with their meate in winter, it will make them lay egges all the winter

more plentifully." Can you tell me if you know of anyone who has tried Parkinson's plan, with his hens, and if so, did he obtain the desired result?

387.—Pear Grafting.—Virgil, in the "Georgics," speaks of pear being grafted on mountain ash (*ornus*). I tried the pear scion on the mountain ash stock two years ago, but without success. My failure may have been due to want of vigour in the stock. Will any reader who has tried grafting pear on mountain ash tell me what was the result of the trial?

388.—Violet Stones.—The name given to certain stones found upon high mountains, as in Thuringia, upon the Harz Mountains, and the Riesengebirge, which in consequence of being covered with what is called violet moss, emits a smell like that of violets. They retain this smell for a long time, and it is increased by moistening. The violet moss (*Byssus Iolithus*), which some botanists have been inclined to rank with lichens and others with fungi, consists of simple articulated threads, and spreads over the stones in the form of a delicate incrustation, which at first is reddish brown, but in a more advanced stage yellowish green. It was formerly in use as a popular remedy for feverish cutaneous eruptions.

The above is an extract from Chambers' "Encyclopædia." Can anyone give a fuller account of the subject, especially of the *Byssus Iolithus*? J. W. G.

389.—Chemical.—Can anyone recommend a good cheap manual of Agricultural Chemistry, with the chemical examination of soils? (Not "Church's Laboratory Guide.") J. A. Hogg.

390.—Names of Fish.—I have scales of the following fish from Mentone:—*Menora*, *Lodola*, *Laserto*, and *Bolta di Mare*. Would someone kindly give the scientific names of each, as these are evidently the local Italian appellations? H. W. Lett, M.A.

391.—Mounting Parasites.—I soaked several specimens of a parasite from holly in spirit of wine for several days, then I mounted in balsam. All the specimens when dry were surrounded by a fringe. Why was this? Were they not soaked long enough? H. W. E.

392.—Snow Crystals.—How may snow crystals as depicted in text books be shown to friends in an ordinary room? Some means of course must be devised to prevent the snow from melting. S.

393.—Liquid Wanted.—Wanted a liquid, not too expensive, boiling at a temperature of from 98° to 100° F. B. A. B.

394. —Pineal Eye.—I have seen allusions lately to the "pineal eye"; can anyone tell me clearly what this organ is? Enquirer.

The Scientific Enquirer.

AUGUST, 1888.

A Short Sketch of the Ichneumons.

By G. H. Bryan, B.A.

Chapter II.

We now pass on to the group Tryphonidæ, of which *Colpotrochia elegans* may be taken as an example. Its colour is shining black, with sulphur-yellow markings. Its legs are short and stout in proportion, and it has a short transverse nervure in the discal areolet.

The Pimplidæ are characterised by their sessile and flattened abdomen, of which the extremity is, in the female, prolonged into a tail, sometimes short, sometimes of considerable length, and containing the ovipositor. The fore-wings possess three posterior marginal cells, of which the middle one is nearly triangular. The scutellum is roundish.

The genus *Pimpla* is distinguished by the knobs on the upper side of the abdomen, and by the long ovipositor, which is developed into a boring apparatus, and which is covered by the tail. The colour of these animals is black, red, bright yellow, or white, never of a muddy yellow, thereby differing from the genus *Therônia*, in which the body is coloured muddy-yellow.

Pimpla varicornis is black, legs red, with pale rings on the hind tibiæ and tarsi, also on the antennæ. There are similar yellow lines on the face in the male sex. The extremity of the scutellum is yellow, which colour prevails more or less on the thorax, there being two yellow lines across the latter between the bases of the wings. The first segment of the abdomen is hollowed out on the

back. This insect is found in Germany, where it attacks the pupæ of one of the Fritillary butterflies, *Melitæa maturna*.

All the CRYPTIDÆ have stalked abdomens almost linear or cuneiform in the males, but in the females, flattened down and drawn out to a tail or terebra. The fore-wings generally have three submarginal cells, of which the middle one is quadrilateral, and is termed the discal areolet. *Cryptus migrator*, a typical example of this family, is of a black ground colour, with the first four segments of the abdomen and legs red, excepting the tarsi of the hind legs, which are black at the extremity. The outer part of the abdomen and a ring round the antennæ of the female are white. The length of this insect is about 11 millimetres.

We now come to the last group of ichneumons, the ICHNEUMONIDÆ, which may fairly rank the highest in importance of all the families of Ichneumonites. It includes thirty-six European genera, among which *Amblytcles* contains fifty and *Ichneumon* over a hundred species inhabiting Germany.

We take the genus *Ichneumon* as a fitting representative of this enormous family. The insects belonging to this genus may be recognised by their flattened petiolate abdomen, which, in the female, contains the ovipositor. In the fore-wings the discal areolet is of a pentagonal form. A very marked difference may be observed between the antennæ of the two sexes in all the species of Ichneumon. Those of the males have joints which are not readily distinguished, and when the insect is dead they continue to remain extended. On the contrary, the female antennæ have very distinct joints, and are frequently also adorned with a white ring ; after the insect has been killed, they always curl up.

Our first example of this genus, *Ichneumon pisorius*, is mostly of a black colour, but from the second segment of the abdomen nearly down to the extremity is dirty yellow. Beyond this the sexes differ considerably in colouring. In the male insect the scutellum is white, while the face and legs are yellow with black spots. In the female the scutellum is pure yellow, with the exception of a line in front of the base of the wings, while the ground colour (black) occurs on the legs only, in a band round the tibiæ. The upper and front borders of the eyes and one joint of the antennæ are yellow. The larvæ of this insect are parasitic on the caterpillars of several hawk-moths.

Our last example is taken from the same genus, and is known to entomologists under the scientific name of *Ichneumon manifestus*.

It is a large conspicuous insect of a reddish brown colour, and about the size of the average "Daddy-long-legs." It generally appears towards the middle of August, and seems to fly about in

the evening, so that if the gas is lit in any room, and the window left open, numbers of these ichneumons will be attracted by the light, and will fly to the lamp and scorch themselves.

The fortunate possessor of a microscope may take an appropriate revenge for this, at times, rather unwelcome intrusion, by mounting the head of this insect, as a transparent object, in balsam without pressure. If the mounting has been properly done, and the specimen be examined under an inch objective, the various organs will be beautifully seen in succession, by gradually focussing down from the upper to the lower parts of the head. First, we see the bases of the antennæ and the three simple eyes; next, the compound eyes and the powerful mandibles come into view. Still screwing down the coarse adjustment, the mandibles become obliterated, and are replaced by the less horny maxillæ or lower jaws, with their long palpi attached; lastly, the labium and its labial palpi, with the delicate tongue or lingua in the centre, are seen when the bottom of the specimen is brought into focus.

We shall conclude these remarks with a brief sketch of the methods of oviposition and life-history of the various Braconites and Ichneumonites.

A few kinds attach their eggs to the external surface of the body of the caterpillar, and the larvæ live outside, but this is not very usual. There are two other methods. One of these is to insert the egg in a puncture made in the skin of the caterpillar; this method is very generally adopted. In the other, the ichneumon attacks the eggs instead of the larvæ of its victim, so that when these hatch and develop, the eggs of ichneumon also hatch inside them, and their larvæ begin to attack the caterpillar at once.

The ichneumon larvæ feed only on the fatty parts of their host, leaving the vital parts untouched. In some cases they emerge from the body of the caterpillar, preparatory to transforming into the pupa state, and their cocoons may be seen hanging, in considerable numbers, attached to the body of their former host, which continues to live. In other cases they remain where they are until the caterpillar containing them has passed into the chrysalis state, and, instead of a moth or butterfly emerging from the pupa case, one or more ichneumons appear in its place. A very nearly full-grown ichneumon larva has been known to emerge from the captured imago of a moth.

When the ichneumons have attained the perfect state, they occasionally feed on the juices of flowers.

There is scarcely a single insect which has not its own special ichneumon, while some species, not content with destroying one kind of insect, attack several. Even those caterpillars which are provided with urticating hairs do not derive any immunity from the attacks of ichneumons, by this protection. Nor are

coleoptera, spiders, and aphides more favoured in this respect. Again, some ichneumons are in their turn attacked by other ichneumons, which are then said to be "hyper-parasitical;" a case of this kind is recorded in *The Entomologist* for May, it having been observed that the larvæ of *Pimpla scanica* are hyper-parasitical on those of *Limneria vulgaris*.

The common cabbage butterfly (*P. rapæ*) and magpie moth (*Abraxas grossulariata*) are very liable to attack from ichneumons, which are thus of very material use in keeping the ravages of these destructive insects in check. It always happens that a super-abundance of any insect is met by a corresponding increase in the numbers of the ichneumons which attack it. So that the more these interesting insects are studied, the more we must admire them, not only for their individual points of interest, but also for the very important part they play in the economy of Nature, in affording a constant check on the too-rapid multiplication of any one species of insect.

Short Papers and Notes.

Curious Formation of Crystals.

IF a lump of granulated pure chloride of ammonium be carefully introduced into a solution of nitrate of lead, best in a wide-mouthed bottle, there will soon appear pillars of crystals resembling, in some respects, the amorpho-crystalline snow-banks. The result is very beautiful; but, besides, affords an excellent opportunity to notice the mode of formation. The minute crystals of chloride of lead will be seen to rise from all sides, at the base of the forming pillars, and, ascending above their summits, will describe an inward curve and fall on top. This process being continued, the pillars will rise rapidly. This is interesting as bearing on the causes of crystalline form. If the commercial fibrous chlorides of ammonium be used instead of that described, the result is extremely remarkable from an artistic point of view, but does not show the currents so distinctly.

A Modern Barometer.

A very good and sensitive barometer may be made by glueing together strips of red cedar and seasoned pine. A strip of cedar, about thirty inches long, one-and-a-half inches wide, and one-eighth of an inch in thickness, is cut with the grain, and to one side of it must be glued strips of pine of equal thickness, with

the grain running across that of the cedar. This combination is set on end, and will, according to the state of the weather, be found to have bent on one side or the other; this may be determined on trial.

A Marine Aquarium.

For an aquarium, whether fresh-water or marine, a tank is better than a globe, because a larger surface of the water is exposed to the air, and the larger the surface of water exposed to the air the greater the quantity of oxygen absorbed from the atmosphere, and the better the health of the inhabitants of the vessel.

A salt water aquarium does not require so much light as a fresh water, therefore give the glass a coat of green paint on all sides but one, which leave clear for the front. The rockery or arch in the centre, cement together with the following cement:— Take ten parts, by measure, litharge, ten parts plaster of Paris, ten parts dry white sand, one part finely powdered rosin, and mix them, when wanted, into a pretty stiff putty with boiled linseed oil; it will be ready for use in three days, and hardens under water. Put an inch of sand from the beach over the bottom of the aquarium. The water should be obtained from the ocean some distance from the shore. Choose such seaweed as you prefer, with the small stones attached, and the stones will sink, keeping the plants in an upright position. A window facing north or south is the best situation for a marine aquarium. Do not introduce the animals till the plants begin to thrive and put forth new shoots, and take care not to put in too many animals. If you do they will surely die, and there must be at all times pure air and perfect ventilation in the room, and there must be no smoking in the room, as the smoke will taint the air and thus the water. Keep a glass over the top of the aquarium to keep out the dust, but it must have standards half an inch long so that there may be a space for the free admission of fresh air.

The water will slowly evaporate, but the salt will not, so you will only have to fill up the tank with water. July and August will be found the hardest months of the year to keep the water pure. Lean beef dried and cut fine may be used for feeding, or oysters or clams chopped fine, or the prepared food which is for sale. Keep the aquarium free from all dead animals, dead vegetation, or surplus food.

When the water becomes foul a filter may be made of a flower pot. Leave a hole in the bottom large enough to insert a goose-quill, then fill the pot half-full, first of a layer of charcoal at the bottom, sand next, and gravel on the top. Hang this filter some distance above the aquarium, and let the water fall into it drop by drop.

In looking for inhabitants go out at extreme low tide, and with a net scoop up almost anything you can find which has been left by the tide. Take the result home and sort it over, culling out what you want, and you will be surprised at your varied collection.

What a Ton of Coal Yields.

A ton of coal yields about 8,000 cubic feet of gas, and 1,500 pounds of coke. The purification of the gas furnishes 45 gallons of ammonia water, from which is obtained sulphate of ammonia for agricultural purposes, and about 130 pounds of tar. It is here that the operation becomes especially interesting, for from this last-named product are obtained 70 pounds of pitch, 18 of creosote, 9 of naptha, 13 of heavy oils, 6 of napthaline, 4 of napthol, 2 of alizarine, about 1 each of phenol, aurine, and aniline (the substance to which we are indebted for such wonderful colours), 10 ounces of toluidine, 6 of anthracine, and 12 of toluene. Finally, it will interest photographers to know that hydroguinon, that product which has been so much spoken of lately, and which was at first obtained from cinchona, is now obtained from coal by industrial processes.—*La Science en Famille.*

The Bull Frog.

In the Bull Frog (Rana pipiens) the larvæ are usually five inches long, and take from two to three years to complete their transformation. They may be hindered in this and be made to take twice that time. In this case the larvæ may attain seven inches in length, but will be tailless.

Volcanic Islands.

According to Murray's theory, the volcanic islands, whose surface is beneath water, are raised by the deposition of calcareous matter until they reach the line at which the coral builders can work. Then the coral maker builds the reefs which rise gradually until they enclose the water in a complete or incomplete ring, and so they form a lagoon. Then comes the deposition within the ring, of detrited particles worn away from the reef by the waves breaking over it, and so the inner channel becomes shallower. This is in opposition to the Darwian theory of subsidence.

A Strange Fight.

The larva of the water-beetle (*Dytiscus marginalis*), says a

correspondent of the *Field*, is well known to naturalists as the formidable antagonist of the young fry in our fish-ponds, and the writer has frequently witnessed scenes of ruthless slaughter on the introduction of one of these beetles into a fresh-water aquarium. Although scarcely two inches in length, it has a formidable appearance with its powerful mandibles and active form. If two dytisci are placed in a small glass bowl, one will very soon transfix the other and decapitate him. The following account of a duel, in which a large garden spider and a dytiscus were the principals, may be of interest:—The spider was placed on an islet of rock-work, in a small aquarium, while dytiscus lurked in a weedy bower beneath the surface; the spider seemed ill at ease, and evidently thought his quarters lacking in those conveniences which are essential to the well-being of web-spinners. It was not long before the dytiscus rose to the surface, and, seeing the stranger by the water's edge, promptly closed with him, seizing the huge body of the spider with his sharp pinchers. The two rolled over in the water, but after a sharp tussel they separated, neither apparently any the worse for the scrimmage. The spider was placed once more on the islet, and by gently disturbing the water with a twig dytiscus was again brought to the scratch, this time with fatal result. The spider at one time had fastened himself on the dytiscus; but the latter, using his pinchers to more purpose than in the first encounter, killed the spider, and the fight was over. Dytiscus, however, was evidently badly hurt, and after some convulsive movements also succumbed.

The Great Yellowstone Geyser.

The Excelsior Geyser in Yellowstone Park, U.S.A., is at present (July, 1888) in eruption. This geyser is in the great middle geyser basin, close to Fire-Hole River. It is in the form of an immense pit, 320 feet in length and 200 feet in width, and the aperture through which it discharges its volume of water is nearly 200 feet in diameter. Its general appearance is that of a huge boiling spring, and for many years its true character was not suspected. Its first eruption occurred in 1880, when it revealed itself as a stupendous geyser. The power of its eruptions was almost incredible, sending an immense column of water to heights of from 100 to 300 feet, and hurling with it rocks and boulders of from one pound to one hundred pounds in weight. The present eruption is said to be a repetition of that of 1880. It is throwing its volumes of water 300 feet into the air, and Fire-Hole River is reported to have risen two feet from its rushing floods. This is now conceded to be the most powerful geyser in existence.

Artificial Sponge-Rearing.

This is being carried out in Styria by Professor O. Schmidt, of Gratz. From a report to the Board of Trade, it appears that the Professor, by taking small pieces of living sponge and planting them in favourable spots, has obtained large sponges in the course of three years. It is stated that 4,000 sponges cost no more for cultivation and interest on capital than 225 francs, and the Austro-Hungarian Government has authorised the protection of this new industry on the coast of Dalmatia.

Practical Hints.

Shading Oak.—A very fine yellow shade may be given to oak by mixing three ounces of tallow, three-fourths of an ounce of wax, and one pint of turpentine. Melt in a kettle of hot water, mix thoroughly, and apply as hot as possible. Polish by rubbing with a piece of leather.

To Brighten Tarnished Gold and Silver.—Wash the articles in one ounce of liquor potassæ, mixed with twenty ounces of water; then rinse them in warm water, after which they should be immersed in a preparation composed of one part of common salt, one part of alum, two parts of saltpetre, and three parts of water. They are to be washed again in water, dried in chamois leather, and placed in sawdust to dry.

To Mellow the Colours of Paintings on Canvas.—A freshly-executed painting may have its colours presented in the mellow tones of the old masters by first covering the back with a coating of Fuller's earth, which absorbs all the remaining oil, and then, on removing it, covering the back with a coat of linseed oil, which the colours presently imbibe. This is the alleged discovery of a celebrated French painter.

To Prepare Stencils.—The best material for paper-stencils is a heavy manilla paper. A day or two before using it, it should be tacked up somewhere, and given a good coat or two of linseed oil. This renders it of the requisite pliability. In cutting the design, the edges should be laid on glass to secure smoothness.

To Polish Mahogany and Walnut Furniture.—Dissolve bees'-wax by heat in spirits of turpentine until the mixture becomes viscid, and rub thoroughly with a flannel or cloth. A gloss may also be obtained by rubbing with linseed oil, and then with a cloth dipped in very fine brick dust.

Imitating Inlay.—Very plain furniture can be rendered quite attractive by painting to imitate real inlay of choice of woods. A long, round sable brush should be used, so that it can expand and straighten according as the parts of the ornament are broad, or show narrow and fine lines.

To Prevent Glue from Cracking.—The addition of a little chloride of calcium to glue will prevent its cracking when exposed to considerable heat.—From the *Decorator and Furnisher.*

How to Use Glue.—For glue to be properly effective, it requires to penetrate the pores of the wood; the more a body of glue penetrates the wood, the more substantial the joint will remain. Glues that take the longest to dry are to be preferred to those that dry quickly, the slow drying being always the strongest, other things being equal. For general use, no method gives such good results as the following:—Break the glue up small, put it into an iron kettle, cover the glue with water, and allow it to soak twelve hours. After soaking, boil until done. Then pour it into an air-tight box, leave the cover off until cold, then cover up tight. As glue is required, cut out a portion, and melt in the usual way. Expose no more of the made glue to the atmosphere for any length of time than is necessary, as the atmosphere is very destructive to made glue, Never heat made glue in a pot that is subject to the direct heat of the fire or lamp. All such methods of heating glue cannot be condemned in terms too severe. Do not use thick glue for joints or veneering. In all cases work it well into the wood, in a similar manner to what painters do with paint. Glue both surfaces of your work, except in cases of veneering. Never glue hot wood, as the hot wood will absorb all the water in the glue too suddenly, and leave only a very little residue.

Artificial Ivory.—Much of the so-called ivory now in use is simply potato. A good, sound potato, washed in diluted sulphuric acid, then boiled in the same solution, and then slowly dried, is all ready to be turned into buttons and innumerable other things for which ivory was formerly used.

Frost-Bites.—A medical journal states that new experiments have changed old theories upon the best methods of treating frost-bites. A physician froze sixty dogs into a condition of completely suspended animation. Twenty of these were treated by the usual method of gradual resuscitation in a warm room, and of these fourteen perished; twenty were treated in a warm apartment, and eight of these died; while the remaining twenty, which were put at once into a hot bath, all recovered.

The Manufacturer's Gazette.

To obtain Nearly-Absolute Alcohol without Distillation.—If gelatine be suspended in ordinary alcohol, it will absorb the water, but as it is insoluble in alcohol, that substance will remain behind, and thus nearly-absolute alcohol may be obtained without distillation.

Photographic Notes.

The Silhouette.—Having had some experience in this line, I will try to describe my *modus operandi*, which is very convenient and inexpensive. The things required are:—Two backgrounds standing on castors. These should, if possible, be of a dark colour; if not, pieces of black calico can be hung over them. A third ground of white muslin and several yards of black calico. Now put the two dark backgrounds nearly parallel to each other, and far enough apart to place the sitter between them. Throw the pieces of black calico over the backgrounds, thus forming a tunnel, at the end of which place the white screen, tipped back slightly to reflect the greatest possible amount of light into the camera. At the other end put the camera, and focus on the sitter's profile. Insert a small stop, so as to get the outline well defined. Should too much light enter this *camera obscura* from the side where the camera stands, shut it out by means of strips of black calico. A little light gives faint details, and is not at all hurtful.—R. Benecke, in *Philadelphia Photographer.*

To make a Tank or Dish Water-tight.—Having tried many ways of treating tanks and wooden dishes to make them water-tight, I have hit on a method that is new to me, viz.:—

Take equal weights of bees'-wax, paraffin, and resin; melt them in a sand-bath, mix well, and apply to the surface with a paint-brush. Cover the whole surface with the mixture, lay on strips of muslin about six inches wide, any length, as it can be stretched more evenly when narrow; iron the surface with a hot flat-iron. Do not have the iron hot enough to cause smoke. In this way cover the whole surface. It will last many months without repair, and needs only a little more of the mixture brushed over and ironed on to make a new surface.

I have a 27 in. by 32 in. hypo. dish that has been in use over a year without repair. New dishes prepared in this way will outlast the plain waxing, as the strain of the dish while emptying solution does not crack the surface. If your wash-tank leaks, dry it out, coat as directed, and it will be all right.—W. L. Shoemaker, in *Photographic Mosaics*, 1888.

To Clear Stained Negatives.—Yellow, pyro-stained negatives may be cleared by placing them in a solution of 2 parts common

salt in 16 parts of water, to which 1 part of diluted sulphuric acid (1 : 8) is added. A few minutes' immersion in the solution makes the negative clear and colourless.—*Photo. Times.*

Answers to Queries.

342.—Chill at Sunrise.– The earth is naturally coldest just before the sun has risen, having then had longest to cool. When the sun begins to warm the earth, the overlying air, becoming heated, ascends, and cold air rushes into its place from the parts not already warmed by the sun, thus producing the cold wind spoken of by your correspondent. MATHEMATICUS.

364.—Removing Grease.—Soak the insect thoroughly with benzine, and then sprinkle French chalk all over the body and wings. At the end of half-an-hour, the chalk may mostly be blown or shaken off, the remainder being carefully removed with a soft camel-hair pencil, moistened, *where necessary*, with benzine. MATHEMATICUS.

365.—Divergent Series.—No recognised name has been given to a series, the differences between the terms of which (or the differences between the differences, and so on) are in arithmetical progression. E. L. H.

365.—Divergent Series.—No method has ever been discovered for finding the sum or value of a divergent series of increasing terms, alternately positive and negative. E. L. H.

367.—Sun putting out the Fire.—This is mainly an optical delusion, the less brilliant flames of the fire being rendered invisible by the far-greater brightness of the sun's rays. But it is just possible that the sun, by heating the surrounding air, prevents the proper draught of air being formed, and thus deadens the combustion of the coal. G. H. B.

370.—Specific Gravity.—How much water must be added to commercial strong solution of ammonia (NH_4OH) sp. gr. ·880, to give it a sp. gr. of ·891?

·891—·880=·011 dif. in sp. gr. between mixture and ammonia; 1·000—·880=·12 dif. in sp. gr. between H_2O and ammonia; $\frac{·011}{·120}$=·09⅙.

∴ 9⅙ parts of mixture is water; or,

$$\frac{9\frac{1}{6}}{109\frac{1}{6}}=\frac{55}{655}=\frac{11}{131}=·08\frac{52}{131}\ (H_2O);$$

∴ $8\frac{52}{131}$ per cent. (H_2O) of the amount of ammonia added to the ammonia solution will give the required sp. gr. E. L. H.

370.—To Increase Specific Gravity.—On reading my own answer in the July number, it occurred to me to try practically whether my theoretical advice would arrive at a practical result. This I knew must be the case if the tables were correct from which the data were taken. The strongest solution of ammonia I had was labelled 880, but had an actual gravity of 884, which, according to the table, contained 36 per cent. of ammonia. This was to be reduced to a gravity of 891, or a solution containing 32·8 per cent. Following out my own instructions in the manner most would have done, I find that $91\frac{1}{5}$ parts of solution of sp.gr. 884 contained the exact amount of ammonia required by the table to make a gravity of 891. Then, *measuring* out $91\frac{1}{5}$ cubic centimetres of solution, 884, I made it up to 100 parts. The specific gravity of this was not 891, but 893. On thinking over the matter, I saw that my parts should not be *measured*, but weighed. Now, as the gravity of the ammonia is 884, it will be necessary to take more than $91\frac{1}{5}$ parts by measure to obtain the weight of ammonia required. 100 cc. of ammonia solution contain only 31·82 grammes of ammonia instead of 36 grammes or 884 multiplied by 36 and divided by 1000. So also 100 cc. of solution of gravity, 891, contain 29·228 grammes instead of 32·8, so that we must by measure take that volume of ammonia of 884 gravity, which contains 29·228 grammes, instead of that which contains 32·8. This amount is 92 cubic centimetres instead of $91\frac{1}{5}$. In the next experiment I therefore took 92 cc. of ammonia solution, 884, and made it up with water to 100 cc. The gravity of this was $891\frac{3}{10}$, or sufficiently near for the purpose. J. W. G.

372.—Microscope.—Your correspondent had better procure "How to Choose a Microscope," by "A Demonstrator," or "The Student's Handbook to the Microscope," by "A Quekett Clubman," either of which will afford much useful information on the choice of the instrument. Baker's "Educational Microscope" at £3 3s. is the cheapest one that would be of much use. Better get a good stand, with inch and $\frac{1}{4}$-inch powers, costing about six guineas; to this, accessories can be added if wanted. A botanical simple microscope is useless except for dissecting purposes.

G. H. B.

372.—Microscope.—It is impossible to give a complete answer to R. C., as he does not say for what purpose he wants a microscope, and even if he gave this, there are many different opinions on the matter, as everyone has his idiosyncracies and prefers the instrument to which he is accustomed.

However, unless R. C. wants an instrument for the *elementary* work of botany or for dissecting purposes only, it may be safely stated that a simple microscope, such as "Henslow's," would not satisfy him. He ought to get a compound microscope—of course,

achromatic, as an unachromatic one is useless for modern requirements. Compound microscopes may be roughly divided into three classes :—Firstly, the complete and expensive instruments of Powell and Lealand, Ross, Beck, Tolles, etc. etc., which are chiefly suitable for the examination of ready-prepared slides, resolutions of diatoms, and all work which wants the highest qualities of lenses to be brought out with the greatest ease and efficiency. Secondly, cheap, flashy instruments, with long tubes, many wheels, and various appliances, got up in imitation of the first class, but of inferior workmanship. These are made for sale, not for use, and should be carefully avoided. Thirdly, working instruments of simpler construction, but of good workmanship. Of these there are many kinds. But it is always advisable to get one of these at first, as, even if the purchaser contemplates getting a first-class instrument, it will always be of use for ordinary work afterwards. In this latter case, one of the cheap, small patterns, with 5- or 6-inch tube, would be most handy.

For full details on microscopes, I must refer R. C. to Carpenter on "The Microscope," Davis's "Practical Microscopy," and other of the larger works, and also to the dealers' catalogues. But a few remarks may be of service here. Microscopes are either binocular or monocular. The usual form of binocular microscope in England is Wenham's, and this can be instantly converted into a monocular form if required. The advantages of a binocular for popular work—such as insects, etc.—is very great ; besides, it gives a stereoscopic effect. For the higher magnifications or for making out small details, the monocular form is preferable. Monocular microscopes are made in two patterns—one with the long English tube, 8 to 10 inches, and the other with the short, foreign tube, 5 to 6 inches. This latter form is preferable when much work has to be done with an upright position (as when liquids are used on the stage), and is, therefore, much used by medical students. If this form is bought, the eye-pieces are better if corrected for the short tube. The chief points to be observed in buying an instrument is to see that the stand is steady in all positions, and it ought, for general work, to have a joint to incline the instrument, as the continual use of the upright position is fatiguing to most persons. The fine motion ought to work smoothly in every way and gradually, without shifting the object laterally ; the coarse motion may be a sliding-tube arrangement, but a rack and pinion is certainly better. The stage ought to be roomy, and I should recommend a plain stage without mechanical movement, except, perhaps, a rotatory one, though this is not so practically important as might be thought ; the body ought to have a draw-tube, and two eye-pieces ought to be got magnifying the initiatory power of the objective (got by dividing 10 inches by

its focus) from 4 to 5 times and from 8 to 10 times—that is to say, an inch ought to give from 40 to 50 diameters with one and 80 to 100 with the other. There ought to be means of applying a polariscope, spot-lens, substage-condenser under the stage, and the focussing ought to allow of the use of at least a 2-inch power, if not a 3-inch. A case is a luxury, as microscopes are kept most conveniently under bell-glasses. The following are the most generally useful magnifications, put in the order of their importance: 40 to 50; 200 to 300; 15 to 25; 400 to 600. These numbers are, of course, only approximate, and are given in diameters. High powers are much improved by the use of a substage-condenser. For general work, the most useful substage appliances run in the following order:—Diaphragm, spot-lens or paraboloid, polariscope, and condenser. If a substage-condenser with stops are got, the spot-lens can be dispensed with, any way at first. The smallest number of things to begin work with is a stand with draw-tube, fine motion and eye-piece, a stand or stage-condenser for opaque objects, and a suitable power for the work undertaken—say, an inch or $\frac{3}{4}$-inch; to this the next to be added is a $\frac{1}{4}$ or $\frac{1}{5}$ inch, and then a second eye-piece. After this experience will teach the rest. Ninety degrees is quite high enough an angle for the $\frac{1}{4}$ inch, as otherwise it will work too close to the object. Always get good objectives from well-known makers. The most popular foreign objectives are those of Zeiss'. The cheapest form of camera-lucida for drawing is Beale's reflector, but I prefer the vertical camera. In this case the paper is put parallel with the stage. One caution: do not be tempted to buy separating objectives, and remember that English objectives, as a rule, work best on 8- to 10-inch tubes and foreign ones on the 6-inch tube. I send the addresses of those mentioned in this reply, but there are other excellent makers. The two best-known firms are—Powell and Lealand, 170 Euston Road, N.W.; Ross and Co., 112 New Bond Street, W. Beck and Co., 68 Cornhill, make very good instruments, and the cheapest I know of is the "Star." Baker and Co., 244 High Holborn, agents for Zeiss and Siebert, also second-hand lenses, etc. J. Coppock, New Bond St., agent for Hartnack, Nachet, and American makers (Tolles, etc.). C. Collins, 157 Gt. Portland St., also sells second-hand lenses and instruments.

In getting a microscope, do not buy too much at once, or you may get appliances you do not want; also, get some good work on the subject before purchasing. John Phin's "How to Use the Microscope" (3/6, ?), Davis's "Practical Microscopy" (7/6), Carpenter, "Microscope," would all suit R. C.

J. G. P. Vereker.

373.—Noctiluca.—In Mr. Griffin's article on this subject in the *Journal of Microscopy*, for January, 1887, the evidence for and against the presence of an excrementary canal in this animal will be found fully discussed. G. H. B.

377.—Plant Crystals.—Oxalate of lime is a bye-product formed in the process of vegetation and has no useful function to perform in the economy of the plant. It is found in largest quantities in the old leaves, and is got rid of when these are shed. G. H. B.

382.—Plant Hairs.—These serve to protect the leaves in several ways:—Firstly, from the attacks of insects, by hindering the smaller kinds (*e.g.*, aphides), from crawling on the leaves; secondly, in some few cases it has been thought to screen the leaf from the fierce glare of the sunlight; lastly, there can be no doubt that in certain cases they prevent particles of dust from settling on the leaves and choking up the stomata. The first use is no doubt the most important, but there are many plants with very woolly leaves, which derive considerable protection from dust from the hairs on them; even after carefully blowing on or shaking them, a considerable amount of dust will still be found arrested by the hairs. G. H. B.

386.—Hens.—Nettles act like all other green food, and causes laying. If greens were given to the hens in winter, and a little more lime, eggs would be much more plentiful at that season than is now the case. V. A. L.

387.—Pear-Grafting.—In grafting trees they should be regulated according to the hardness of their wood. Soft wood grows faster than hard, and consequently causes death to the tree in time. It is common in America for new comers to find soft and hard wood trees grafted together, and in a few years one falls apart from the other by its own weight, and thus dies. I have noticed this in cherry-trees particularly. V. A. L.

389.—Chemical.—See Francis Sutton on "Volumetric Analysis" (Churchill, 16/-); Dragendorff's "Quantitative and Qualitative Plant Analysis" (Baillière, 7/6); Frankland's "Agricultural Chemical Analysis" (Macmillan, 7/6); Ville on "Artificial Manures," 31 plates (Longmans, £1 1s.). V. A. L.

389.—Chemical.—I would recommend Mr. Hogg to get "The Handbook of the Farm Series." These are edited by J. Chalmers Morton, and comprise—1, Chemistry of the Farm; 2, Live Stock of the Farm; 3, Crops of the Farm; 4, Soil of the Farm; 5, Plant-Life of the Farm; 6, Equipment of the Farm. They are sold separately at 2/6 each (Bradbury). A.

389.—Chemical.—"Agricultural Chemical Analysis," by F. F. Frankland (Macmillan, 7/6); "Elements of Agricultural Chemistry and Geology," by Johnston and Cameron (W. Blackwood,

6/6). The former will probably suit the enquirer the better of the two. J. W. G.

393.—Liquid wanted.—It is difficult to obtain a *cheap* liquid whose boiling point occurs between the limits 98° to 100° F. Ether is the nearest, and would probably answer, especially if kept under the slightest pressure, as its normal B.P. is 96° F. There is, however, a variety of petroleum, which boils at exactly 98° F, but I am not aware if it is a commercial article. J. W. G.

393.—Liquid wanted.—In reply to B. O. B., Carbon Disulphide, CS_2, comes pretty close to what he asks, as it boils at about 110° F., but I should not recommend him to try the experiment, as it is very inflammable. J. G. P. VEREKER.

394.—Pineal Eye.—Perhaps the following note, extracted from the *Dental Record* for April, may interest "Enquirer":—"The existence of a third eye in lizards—named by anatomists the parietal or pineal eye—is also shown to extend to many others of the vertebrates. It was first pointed out in lizards by Graaf and Spencer, and has been further studied by M. Francotte in reptilian embryos, in all of which the nerve connections have been distinctly traced from the epiphysis at the root of the thalamen cephalon to the complete development of the pineal organ; but in each of these the optic nerve which connected the organ with the nerve-centres disappears in the adult forms. In the lamprey Beard has found it highly developed in a sac under the skin, just behind the nose, with a retina, pigment, and the remains of a lens. It is interesting to note that the rods of a retina in the parietal eye are turned towards the light, while in the paired eyes they are turned from it." A.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question or answer is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply. All answers should be sent to the Editor, 1 Cambridge Place, Bath, and must reach him before the 12th of the month.

395.—Infinite and other Series.—I thank Mr. Bryan for his reply (p. 118); but owing to my queries not being sufficiently explicit, he has not told me exactly what I want to know. It would indeed seem at first sight that an infinite divergent series, such as $1-5+15-35+70-126$, etc., *ad infinitum*, can have no calculable finite sum or value whatever. Nevertheless, this very

series is the expansion of $(1 + 1)^{-5}$ by the binomial theorem, and is therefore equal to $\frac{1}{32}$. What I desire to know is, whether any mathematician has given a way for finding out the values of such infinite divergent series, that would be intelligible to a person who knows nothing of the binomial theorem.

Respecting the other kind of series mentioned in my query, the fact that both my examples were series of figurate numbers, has evidently tended to obscure my meaning. I want to know if there is a general name for *all* series, the differences between the terms of which are in arithmetical progression. Under the word "differences" I include also the differences between differences—*i.e.*, second differences, third differences, and so on. Here are two more examples (not figurate numbers this time):—7, 8, 8, 8, 9, 12, 18, . . . etc., the second differences between which are—1, 0, 1, 2, 3, ... etc. And 5, 6, 6, 7, 12, 25, 51, ... etc., the third differences between which are 2, 3, 4, 5, ... etc.

Colenso, in his "Algebra," calls these series a "kind of Arithmetical Progression" (or words to that effect); but as an Arithmetical series is one in which there is the same difference between all the terms, such use of the word is hardly suitable. If no other designation has ever been applied, I should suggest "Differential Series" as an appropriate term for all this kind, including, of course, the arithmetical. F. S. S.

396.—Microscope Lamp.—Is there much benefit to be derived from using a lamp specially made for the microscope as compared with an ordinary clear-burning petroleum lamp? I intend getting a $\frac{1}{6}$-inch objective, and having never used a higher power than $\frac{1}{4}$-inch, I would feel much obliged by some one informing me if I could work satisfactorily with an ordinary table-lamp, or would it be necessary to get one from a microscope-dealer? If the latter, please let me know the name of a cheap, handy form, and from whom I can obtain it. I would be very glad to know of any article in any of the microscopic journals on lamps and the mode of using them to the best advantage. J. H.

397.—Camera Lucida.—Would some one kindly recommend me a Camera Lucida which is easy to use and of a moderately reasonable price? Strasburger, in his "Practical Botany," recommends Abbé's, price 30/-, but this is only adjusted for eye-pieces of the continental size. My microscope is a Beck's "Star," with Nos. 2 and 3 eye-pieces. I have read that it is better to get a camera which can be used with the instrument in a vertical position. I require it for botanical work. J. H.

398.—Animal Intelligence.—Have any systematic steps been taken lately with a view of ascertaining of what mental progress dogs or other animals are capable? ZOOPHILIST.

399.—Dry Mounting.—I shall be very glad of any information as to the simplest and quickest method or methods of neatly and effectually preparing dry mounts for the microscope. I daresay this will bring a reply from some kind reader, who will smile at such an apparently simple request. That is the reader to whom I would specially appeal. There are many methods of "putting-up" dry objects as there are of fixing in balsam, which latter process is simple enough to me, but was anything *but* simple when I first tackled the process. To balsam mounts I have so far confined myself, but my dry objects are accumulating, and I shall be much obliged to any "dry-mount friend" who will give me a "wrinkle" or two.

Does any reader know anything of the "rings with an internal flange at the top and an external flange at the bottom," figured and described in the *English Mechanic*, 1,158, June 3, 1887, in an article entitled "A Quick Method of Mounting Dry Objects." The paper in question originally appeared in the *Scientific American*," and the mode of putting up dry objects for the cabinet as explained by the writer (G. M. Hopkins) rather takes my fancy, if I knew where to procure the rings and the heating-tool. F. R. B.

400.—Abbe Microscope-Condenser.—Will some reader of the *Enquirer*, who has good experience of the "Abbe" condenser, kindly say whether it is all that Zeiss states it to be in his catalogue? It is asserted that, with the combination of 1·40 N.A., it will easily afford any and every modification of light of the most extreme obliquity for resolving the severest diatom tests with the highest-angle lenses, that it will give dark-ground illumination up to 600 diameters, and that the various results are *easily* produced by merely changing and moving the different diaphragms supplied with it. Any information hereon will be acceptable. I should also like to know how it performs as an immersion condenser, and whether a good dark-ground with the polariscope is afforded by it. I have no doubt that more than one reader of the *Enquirer* will be able to furnish the required particulars, and that they will be very useful to readers generally, as they certainly will be to

B. R. F.

401.—Poison of Bees, Wasps, etc.—What is the nature of the poison of these insects, and what are its chemical constituents?

A .C

402.—Odontomes.—Will some one tell me the best medium in which to mount sections of odontomes and skins? Z. M.

403.—Card Specimens.—What is meant by "Card Specimens"? It is a term used in medical societies. B. W.

404.—Soda-Lye.—What is soda-lye, how is it made, and where may it be procured? X.

405.—Chironomus plumosus (Linn.), or **Tipula plumosa** (Linn.) In the June and July numbers of *Science Gossip*, Mr. H. Thomas gives an account of the development of an insect he calls "Tipula plumosa." But what seems to me the same insect is called by Kirby, Cuvier, W. H. Bath, and E. A. Butler, "Chironomus plumosus, Linn."

Which is the *correct* name? By the description of larva and pupa or nymph in these works, it seems clear that the insect is the same. OSMANLI (Constantinople).

406.—Swift's "Stephenson's Binocular Dissecting Micro."—Will any reader of *Scientific Enquirer*, who has had *practical experience* of this micro., oblige by giving his opinion of the advantages and disadvantages of this form, as before buying one, I should like to have some information? OSMANLI (Constantinople).

Reviews.

RESEARCH: A Monthly Illustrated Journal of Science. Edited by A. Norman Tate, F.I.C., F.C.S., F.G.S., F.R.M.S., etc. Vol. I., No. 1, July, 1888. Price 3d.

It is with much pleasure that we have read the first number of this new journal. It is a handsomely got-up demy 4to, and if the first number is a fair specimen of what we are to expect in the future—which we cannot doubt, knowing the great ability of the editor—we feel that we can confidently promise it a great success. We can only briefly allude to its contents, which, among other interesting articles, comprise—Local Museums, No. 1; The Scientific Aspect of Health Resorts—No. 1, Harrogate, by the Editor, illustrated; Our Portrait Gallery—No. 1, The Rev. Henry H. Higgins, with a fine plate portrait; River Deposits; A Phenomenon, by W. Narramore; Ornithological Notes; Reports of Societies; Reviews; etc. etc.

LIFE-LORE: A Monthly Magazine of Natural History. Vol. I., Part I. July, 1888. Price 6d. Crown 4to, pp. 24. (London: W. Mawer, 4 Essex Street, Strand.)

A very nicely got-up and well-illustrated magazine. Amongst the table of contents we have only space to notice an exceedingly interesting article on Sea-Wrack, a chapter on the Fucaceæ, by D. Houston, F.L.S., illustrated by four well-executed engravings. The Naturalist's Library gives a lengthy review of Belt's "Naturalist in Nicaragua," with one illustration; Reviews of New Books; Great Natural History Collections; The Newcastle-on-Tyne Museum; Chit-Chat; Collecting Bag, a selection of interesting facts; The Young Naturalist, a chapter for the young people, in which a picture-puzzle of the feet of animals is given, and a prize offered for the best solution; Queries and Replies. We have received a prospectus of Nos. 2 and 3, which is very attractive.

THE COMPETITIVE EXAMINATION PAPERS in Pure Mathematics, Stages I.—III., arranged more particularly for Students in Science Classes and for Teachers preparing for the Government Certificate in Mathematics. By N. C. Potter. 12mo, pp, 84. (London: Moffatt and Paige.) Price 1s. 6d.

These examination papers are arranged for students in science classes and for teachers preparing for the Government certificate in mathematics. The questions are well selected, and a useful summary of algebraical and trigonometrical formulæ is placed at the beginning of the book.

Moffatt's Elements of Euclid, Books I.—II., and Elementary Mensuration, with Explanatory Notes, Exercises, and Deductions worked out as Models. Third edition, revised and enlarged. 12mo, pp. 206. (London: Moffatt and Paige.) Price 2s.

The arrangement of the text will be helpful to the young student. The notes and deductions are very good, as also are the hints given for solving "riders." For testing his knowledge of the order of Euclid's propositions, the enunciations are given separately. The mensuration appended is a capital way of showing the practical side of geometry, and we cannot speak too highly of the last 40 pages.

Traite Pratique de Phototypie. Par Geymet. Nouvelle edition.

Traite Pratique de Photolithographie. Par Geymet. Troisième édition, entièrement refondue et augmentee.

Traite Pratique d'Impression Photographique, aux encres grasses de Phototypographie et de Photogravure. Par Moock. 3*e* édition, entièrement refondue par Geymet.

Traite Pratique de Gravure en Demi-Teinte. Par L'Intervention exclusive. Du Cliche Photographique. Par Geymet.

Paris: Gauthier Villars et Fils, editeurs de la Bibliothéque Photographique. (Quai des Grands-Augustins. 1888.)

We have before us four treatises, issuing from the prolific press of Messrs. Gauthier-Villars, which deal with photography in what, if not new, is one of its most important aspects. So long as the reproduction of the images of the camera was confined to proofs obtained by a second photographic process, so long must its results be very limited, both as to number and utility. With the introduction of a process, however imperfect, whereby the photographic image could be transferred to some medium, from which it could be printed off after the manner of an engraved plate, or a lithographic stone, or of type, a new era commences. And now, as a matter of business, it seems as if it were in this direction that the future of photography lies. Those who take an interest in the application of photography to book-illustration, to business purposes, and to the innumerable uses to which cheap and correct delineation of objects can be applied, will receive much information from Mons. Geymet's treatises, which lay down very clearly the fundamental principles on which the various processes are based, and then go into all the details with a precision that leaves nothing to be desired.

The Taking of Dover. By H. F. Lester. Crown 8vo, pp. 44. (Bristol: Arrowsmith. London: Simpkin, Marshall, and Co.) Price 6d.

It is not often that we can afford space for this class of book. The one before us, however, may form an exception. It is supposed to be the translation of a French letter written in 1898 from the General by whose schemings Dover was captured in 1894, to his son, a student at St. Cyr Military Training College. The narrative is, of course, overdrawn, but is nevertheless worth reading.

Photographic Holiday Work is the summer special number of the Amateur Photographer, and is an out-and-out good number; we advise all our Photographic friends to secure a copy. We are told a second edition has already been called for.

The Scientific Enquirer.

SEPTEMBER, 1888.

*The Salt Industry in Cheshire.**

By Lucy E. Boole.

Part I.

A FEW weeks ago I was staying near Liverpool, and had the opportunity of one day going over to Cheshire to see some salt-works. I certainly knew before of the existence of salt in Cheshire, but the whole process of obtaining it was entirely new to me, and though I do not suppose others are as ignorant upon the subject as I was, still I venture to offer you a short account of it, hoping that it will not be wholly uninteresting. I was fortunate enough to be taken over by one of the owners of the salt estates, and he has been extremely kind in giving me information and specimens.

Before entering upon a description of the works, it will be perhaps better just to refer to the manner in which the Cheshire salt-beds lie. For this I must ask you to look at the diagram.

This represents a vertical section of part of Cheshire. The top line represents the surface soil, about 6 feet in depth. This next stratum, tinted brown, consists of marlstone and limy clays mixed with sandstone, 180 feet, then comes a layer of solid flagstone about 3 feet thick. Immediately below this is the top stratum of rock-salt coloured pink. This is about 120 feet thick. After this comes another layer of marlstone 35 feet, and lastly the lower stratum of rock salt about the same depth as the upper one —*i.e.*, 120 feet. In this lower stratum of salt are situated all the mines worked at the present time. There does not seem to be very much known about whether the strata are continuous or not, but it is known that flagstone is found all over the Weaver valley, though not all over Cheshire.

Rock salt was first discovered in England in the year 1670 by

* From *The Pharmaceutical Journal.*

a lady, Miss Smith Berry, of Marbery Hall, Northwich, in the middle part of Cheshire. This discovery was of the upper stratum of salt. Mines were then started and worked in this top bed up to the year 1778—*i.e.*, for rather more than one hundred years. As this bed lies only from 40 to 60 yards below the surface of the earth, the result was that all the Northwich town and district began sinking into the mines, and have indeed been steadily doing so for the whole of this century. Mines were afterwards made in the lower stratum of salt, 100—160 yards below the surface. This stratum was found to be more free from impurities in the shape of clays and marls, etc., than the upper ones. At the present time the mines in the lower stratum are the only ones being worked, all those in the upper one having been abandoned.

Besides this rock salt, which can be obtained only by mining, salt also exists in Cheshire in a totally different form—namely, natural brine. This natural brine is the source of almost all our ordinary white salts, which are, of course, obtained by evaporation and crystallisation. Natural brine was used in Cheshire for obtaining salt as early as the time of the Romans and Saxons, long before rock salt was discovered there at all, and leaden pans have been found measuring 6 by 4 feet, which were in all probability used by the Romans for that purpose.

The brine is found in this way :—When a shaft is sunk down to the flagstone, and the flagstone is bored through, *in some places* brine rushes up, though many bores have been made without any brine appearing. This seems to indicate that the brine exists in streams between the flagstone and the upper stratum of salt, but does not cover the whole surface of the salt.

Brine formerly flowed to the surface of the land in a few places. There is record of its having done so as late as the reign of Edward I., and even now there is a field in Nantwich, near the middle of Cheshire, where a bottle of it was actually collected by one of the present mine-owners a very short time ago. Possibly, it might be more often found at the surface than it is, if people only searched for it. Nevertheless, it is undoubtedly lower in level than formerly, for it is known that at Northwich it has fallen in three centuries from the surface to the present level, 40 or 50 yards down, and at Winsford, where salt has only been made one hundred and fifty years, it has fallen from 15 to 50 yards beneath.

The reason why it is lower is supposed to be this :—Before brine was used by man, the sandstone basin in the lower parts was probably soaked with it, and any excess flowed, as it still does in some places, into the river. But when it was used largely for manufacture, what was already in the soil gradually became exhausted. This first happened in 1875, when a failure in brine was noticed in all shafts. The old stores being exhausted, the

only brine to be obtained is that produced by rainfall from year to year; and after a very dry season, there is a perceptible diminution in the supply, so that in a way we are living from hand to mouth with regard to natural brine. It rarely rises nowadays many yards above the rock-salt stratum.

Much of the brine now obtained (nearly *all* of that in the old salt region of Northwich) is of a semi-artificial nature. It is pumped from the *old mines*, and is probably formed almost entirely by the surface water getting down old shafts and the many vast holes and cracks now made in that region. In this way even the small pillars of those mines have been melted and the salt immediately under the town and valley is being dissolved. In the Winsford region, which makes two-thirds of the whole salt made, the brine is all *quite* natural.

No one is known to have ever traced a brine stream underground; it is only to be seen running in at the bottom of the shafts. In one place a large natural cave had formed where the stream was running in, and someone once tried to walk along, but the soil and stones were too loose to be traversed with safety for more than a very short distance.

The theory about it is that the brine is forced up by the action of gravity, as in the case of artesian wells, though there is no direct proof of this. It certainly seems to be the most probable explanation when we come to look into the facts. Cheshire is known, from various circumstances (such as the borings for water, etc.), to be geologically in the form of a large basin. On the west are the Edisbury hills, and on the east and south-east the hills of Alderly Edge and Macclesfield. On the north side is a part with no hills, but a kind of cut, which may be represented as a lip of the basin, and outside this runs the river Mersey. From south to north, running right across the middle of the basin, is the valley of the river Weaver. As the layer of flagstone does not extend right over the hills, which consist chiefly of the new red sandstone that absorbs water like a sponge, the rain that falls in those parts soaks down below the surface, and then, flowing in the direction of the lower part of the basin, gets in under the flagstone. Besides this, some rain will always run through the stone itself, wherever there may be cracks or holes, so that altogether a good deal of water manages to get down to the top rock-salt stratum. As it flows towards the lower part of the basin, it gradually becomes converted into brine, by dissolving the salt over which it is running. It seems that this dissolving takes place in the higher parts of Cheshire only, for by the time it reaches the lower parts it has become an almost saturated solution. In fact, it is then so dense that any rain-water from the soil above, coming in direct contact with it, through gaps in the flagstone, will not, on account of the

difference in sp. gr., mix with it for many days, but lies on the top sometimes for a depth of 3 or 4 inches. This has been observed by the men who go down the shaft, and no doubt it is the case wherever there is very strong brine. Thus it is that the rock salt in the lower part of Cheshire is only *very, very* slightly, if at all, becoming dissolved. That it is dissolving in the higher parts is inferred from the fact that the land, at long distances from the middle of the county where all the salt-works are situated, and at a higher level than the works, is steadily sinking in. Thus it seems that the sinking of Cheshire is due to two causes—in the higher parts to the dissolving of the rock salt and in the lower parts to the falling in of the old mines.

Now, the fact that the salt in the middle of Cheshire is not dissolving is a matter of great importance to the brine workers, for the inhabitants of that part are trying to get compensation out of the owners of the brine works, because, they say, this pumping up of the natural brine is causing the land to fall in. But this is not the case, for it is found that the land only sinks at that part, if there happen to be an old mine underneath, and that where there are brine works, and no old mines, no sinking occurs. It has been noticed that six months after a very dry season the supply of brine becomes lower in the shafts. This seems to indicate that the fallen rain takes that time to run its course before it appears as brine.

At most places in England where salt exists at all there are both rock salt mines and also brine works, but at Droitwich, in Worcestershire, there are two brine works and no mines. In Middlesburgh, Yorkshire, rock salt was found, in 1858, 1200 ft. below the surface. It was untouched till 1872. Then the great iron master, Sir Lowthian Bell, let fresh water down on it, and pumped it up again as brine. His great idea was to boil this brine by means of the waste heat from the iron-furnaces, and this has now been carried into practice. There are many large salt-works at Middlesburgh, which are making 200,000 tons per annum for the adjacent Newcastle chemical works.

The Advance of Science.

AS the world grows older, and as the generations pass away and their places are taken by the rising generation, science progresses; and the mysteries that puzzled the alchemists of the middle ages are now made clear by new light, shed by the investigations made in the general advance of science.

As we stand and gaze on the ruined structures reared by the ancient art of Babylon, Nineveh, and Egypt, we feel an awe inspired by those once mighty structures. But when we pause to think that the demon was the cause of the erection of these noble monuments of ancient civilisation, we cannot but rejoice at the more peaceful arts of the present era. The builders of these seem to have been admirers of a grand, massive, and imposing style; and it was not until some centuries later, that the fine and beautiful architecture of the Greeks and Romans made its appearance.

Dew was regarded by the ancients as ethereal, and they believed that if a lark's egg were to be filled with it, that at sunrise it would fly off into space. But we are not informed that this interesting experiment was ever performed. The Greeks knew that amber, when rubbed, would attract bits of straw, feathers, etc., and from this remarkable quality it was supposed to possess a soul! From the Greek name for this substance (Electron) our word electricity is derived.

As late as the fifteenth century, questions like the following were discussed in France: "How many angels can stand on the point of a needle at the same time?" Such a question at the present time would be regarded as ridiculous in the extreme; yet that and many similar ones were once as earnestly discussed by the best educated men of France, and with as much interest, as the scientists of the present day discuss some newly discovered phenomenon in geology, chemistry, astronomy, or other branch of science.

The ancients regarded the stars as gods. There was a god of war, a god of the vine, and so on, every department of art having its special divinity. But the investigations of modern science prove that many of these stars (the planets) are worlds, and with like diurnal revolutions; while some of them are accompanied by satellites, and it is very probable, also, that some are inhabited. Others of these stars are suns, which, like our own luminary, have their peculiar systems of planets revolving around them. These stars are so very remote from us and each other, that the human mind is totally incapable of comprehending the distance.

Then, again, the earth was regarded as an extended plain which rested upon the back of an elephant, that on a tortoise, and that on an immense serpent, and so on indefinitely. But modern science has shown the fallacy of this theory also, and proved that the earth is a globe, suspended in space and revolving around its source of light in an orbit of over 500 billion miles in circumference.

Fossils formed during the different periods that passed in fitting this earth for the habitation of man, were regarded as freaks of

nature; and fossil remains were supposed to be the bones of fallen angels! Later, these and similar remains were thought to be the skeletons of a race of giants, supposed to have once inhabited the earth. But as time flew on, the science of geology arose, and has successfully proved these to be the remains of mammoth quadrupeds, which unknown ages ago roamed over this earth in perfect freedom, while huge reptiles, equally terrible, took possession and maintained undisputed sway over the Triasic and Jurasic seas. Fragments of the bones of these huge monsters, and also gems like the amethyst and ruby, were supposed to possess miraculous virtues and great healing properties.

Electricity, as lightning and in other forms, was regarded as being sent out by the gods to manifest their displeasure for some offence. But here again modern science has triumphed, and has made even this powerful element subservient to its will. And, while we have no proof that the ancients had any superstitious fear of steam, it is certain they knew nothing of its great power. But this, too, by the aid of modern genius, man has brought under subjection and caused to labour for his benefit.

Of the art of printing they knew nothing, and it seems strange, too, that they should not; for the Babylonians used a kind of hand-stamp in stamping their tables, bricks, and pottery; and the Romans used a ring with a device for stamping seals upon their parchments. But they went no further. This, too, was left for a more modern mind to discover. But let us remember that though, through the investigations and discoveries of modern science, we possess many advantages, and of inestimable value, Egypt, Chaldea, Greece, and Rome, all contributed in some way to the general advance of science; whether by their errors or by their discoveries, they may each claim a share. As the ages roll on, new discoveries will be made and new facts added to science, which is ever seeking new and important truths to add to its already well-filled garner.

But science is still in its youth, and its alphabet is hardly learned. As we turn over the pages of the book of Nature, the mind is bewildered with the magnitude and splendour of the study. But the study is as attractive as it is vast, and the close observer ever

> "Finds tongues in trees, books in the running brooks,
> Sermons in stones, and good in everything."

CHAS. D. PENDELL,
in West American Scientist.

Short Papers and Notes.

Indian Insects.

THE July number of *Blackwood* contains an article on the insects of India, whose presence cannot be escaped or ignored : an active life by which one is surrounded—a source of annoyance, sometimes of torment, yet often enough of wonder and admiration. The first to welcome the European, the last to bid him farewell, is the mosquito. But in most places, excepting uncleared jungles, the terrors of the mosquito are trifling and are soon ignored. More interesting, if hardly less harassing to mankind, are the countless armies of the ant, whose regiments are met daily route-marching through your garden ; whose flying columns traverse every room of your house ; whose siege-trains undermine your walls ; and whose scouts are ever on the alert for plunder.

The White Ant.

The white ant is in many ways wholly unlike the common herd. Of all his kind the most destructive, there seems to be attached to him something of the dignity of the superior caste. He does not belong to the restless, novelty-seeking races which skirmish far and wide in small companies. He never runs across your hand or your writing paper, or climbs aimlessly up your legs. Moving only in masses, he does not lightly invade any place, nor does he lightly leave the place he has invaded. Soberly and of set purpose he sits down before some rich treasure house, whether of soft wood or paper, of cloth or leather, perceived from afar by that marvellously keen sense which seems common to every tribe of the species. Unable to bear the light of day, he carries his approaches under covered trenches of mud, thrown up as he advances. These he is at no pains to conceal, so that his presence is at once betrayed and his dearest plans may be easily frustrated. But woe to the book-shelf, the wardrobe, or even the house-timbers to which he once gains access unobserved. His followers are legion ; their weapons are sharp ; and their energy is inexhaustible. In a single night the contents of shelf or box will be reduced to powder, and when the lid is lifted and the unwonted light betrays the scared and swarming thousands of the enemy, the work of destruction is done. "Destroyed by white ants" is an accepted explanation of the loss of official papers in India ; and a defaulting cashier has been known to offer the same account even of missing bags or rupees.

Wasps.

The Indian wasp is a disappointing creature, without any of the *beauté du diable* of the wasp of our childhood, of which he seems to be but a dreamy image. Instead of the compact active creature we know so well, of brilliant yellow and black, the Indian wasp is long and thin of body, of a uniform pale-brownish yellow. Of lazy habit, his legs trail feebly after him as he flies; and though in reality no less venomous than other wasps, it is rather as a crawling intruder than as an armed enemy that he is pursued and killed. This is the wasp proper. But there is a tiny species of wasp, of very different habit, of which the Indian gardener soon learns to beware. Seldom noticed alone, and often not discovered till too late, this lively little creature loves to build bee-like combs in your favourite garden shrubs. Brushing past such a shrub in your walk, or trimming a luxuriant branch, you will quickly be made aware that you have trespassed on the preserves of an armed and revengeful tribe. Dashing out fearlessly in a body from the cover, and making straight for your face and neck and hands, they will sting you fiercely wherever the flesh is exposed, and will follow up the pursuit till you escape beyond their reach. The pain of the sting is sudden and severe, but not lasting, and in a few minutes the irritation passes away; but it is severe enough to teach you to be on the watch henceforth for a new ambush in the garden.

An Arch-Fiend.

"I should like to make your flesh creep" is the involuntary thought of one who essays to describe the Indian cockroach. In the daytime the cockroach lies hid, but no sooner are the lamps lighted than he wakes to his nightly career of ghastly play and plunder. On the first day of the voyage, you will kill one or two, and hope you are rid of them; but it was an idle feat—the place of the slain is quickly taken by others, and the reserve is inexhaustible. Your cabin become untenable, and you resign it to the cockroach; or, if you must sleep there, you hurry off your clothes in a fever of haste and dash into the shelter of your curtains, where you hope for peace, and, if proper care is taken, may find it. If you sleep without curtains, tradition has it that the cockroach will feed on your nails and eyebrows. But besides this arch-fiend there are other varieties of the cockroach, differing from him and each other in shape and colour, and only less insufferable because less aggressive. But of whatever form or size or colour, the cockroach, whose acquaintance is forced on every man who treads the soil of India, is of all created insects the most repulsive, but unfortunately one of the most prolific.

Concluding his paper the writer says:—A volume would not

suffice to tell of the tribes of moths, from the giant Atlas to the silvery gem bordered with vermilion; of locust-fights that give new reality to the stories of the Pentateuch; of crickets which seem to have strayed from the English hearth or the crevices of kitchen-walls; of big bouncing things, half-cricket, half-grasshopper; of insects of which no man can distinguish head from tail; and of ten thousand creatures, unnamed, unclassified, to whom it seems indifferent whether they run, or hop, or walk, or fly, and who, to the embarrassment of mankind, seem ever undecided which to do.

Hectograph Sheets.

Soak 4 parts of best white glue in a mixture of 5 parts of water, and 3 parts of solution ammonia, until the glue is soft. Warm the mixture until the glue is dissolved, and add 3 parts of granulated sugar, and 8 parts of glycerine, stirring well, and letting come to the boiling point. While hot, paint it on white blotting paper with a broad copying brush, until the paper is thoroughly soaked, and a thin coating remains on the surface. Allow it to dry for two or three days, and it is then ready for use. An aniline ink should be used for writing, and before transferring to the blotting paper, wet the latter with a damp sponge, and allow it to stand one or two minutes. Then proceed to make copies in the usual way. If the sheets are laid aside for two days, the old writing sinks in and does not require to be washed off.

Chemist and Druggist.

Destruction Wrought by Insects in America.

The annual loss to productive industries in the United States caused by insects, is estimated at $150,000,000 (£30,000,000). There is a fair battle between man and another sort of earth occupiers. They are smaller, but if they can whip us, have undoubtedly as good a right to the world as we have. As civilization advances, new insects make their appearance, marching sometimes eastward, but generally westward. There are few, if any, forms of vegetation that have no parasites, which devour either foliage or fruit. The loss to the cotton crop is estimated at $15,000,000 (£3,000,000) a year, while that to the apple crop is not much less, and that to the potato crop at least one-half as much. But the estimate is not a fair one until to the loss is counted the time spent in fighting to secure the proportion that is saved.

Scientific American.

Whistling Speech.

At the last meeting of the Berlin Anthropological Society, Lieutenant Quedenfeldt, a German officer, who has lived in Gomero Island, one of the Canary group, described a whistling language which is used by the inhabitants. The language does not consist of any arbitrary series of sounds. It is described as ordinary speech translated into articulate whistling, each syllable having its own appropriate tone. The Gomero uses both fingers and lips when whistling, and Lieut. Quedenfeldt asserts that he can carry on a conversation with a neighbour a mile off, who perfectly understands all he is saying. The practice is confined to Gomero Island, and is quite unknown to the other islands in the Archipelago. The adoption of the whistling language is said to be due to the peculiar geographical construction of Gomero island. It is traversed by numerous gullies and deep ravines, running out in all directions from the central plateau. As they are not bridged they can only be crossed with great difficulty; hence a man living within a stone's throw of another in a straight line, has often to go many miles when he wishes to see or speak to his neighbour. This, it is conjectured, led to the adoption of whistling as a useful means of communication, which has gradually assumed the proportions of a true substitute for speech. *St. James's Gazette.*

A Warning.

The Vicar of Midgham, Reading, writes :—"On Friday last a man in my employment, who was grass-trimming in my garden with a hook, took shelter under an elm tree during a heavy shower of rain, and I myself was taking shelter in a greenhouse close by. I can testify that there was not at the time or near the time any lightning or thunder seen or heard. When under the tree the man was employing his time in sharpening his hook, and whilst in the act of so doing, or at the moment he had finished, he heard, as he describes it, a hissing noise, and in an instant he was knocked against the tree, the sleeve of his shirt (his coat was off) was slit from top to bottom; his arm, the hand of which held the hook, was rendered powerless; the hook itself was completely doubled up, and there was a hole in the brim of his felt hat about the size of a florin. He has since recovered the use of his arm. I write this letter in the hope that you may think fit to insert it for the purpose of warning workmen against holding their metal tools in their hands when taking shelter whilst thunderstorms are prevailing, even if there should be nothing to indicate that there is one in close proximity to themselves. It may also have the effect of eliciting the opinion of some man of science as to whether the fact that the man was sharpening the hook with a whetstone would at all account for the discharge of electric fluid."—*Daily Telegraph.*

The Magnesium Light in Photography.

Professor Dr. Hermann Cohn, Breslau, is of opinion that the "lightning powder" used of late (consisting of magnesium powdered and chlorate of potash in equal parts) is disadvantageous, for the following reasons:—1. On account of the dangerous character of this powder it cannot be prepared in large quantities and stored for use, but must be carefully prepared for use as occasion requires. 2. It is not easy to set on fire at the precise moment desired, even with the electric spark. Fuming sulphuric acid will do this, Dr. Cohn has been told, but this is not a desirable substance to deal with, as its vapour would damage any delicate apparatus in the vicinity. 3. It is not always desirable to have a double illumination. 4. The light should be "photochemical." Professor Cohn obviates all these inconveniences by using simple magnesium powder, which is then blown through any flame in use by means of a simple little apparatus (which may be obtained for 3s. from Herr Pusch, Breslau, Schmiedebrücke 46). Armed with this and a small benzine lamp, anyone can produce a momentary and brilliant illumination, and with this may obtain photographs anywhere and at any time. Magnesium is only about 2d. a grain, and a grain or two amply suffices. For medical photographers nothing can be simpler than Professor Cohn's magnesium benzine light.—*British Medical Journal.*

Photographic Notes.

Etching upon Boxwood Blocks.—Photographic etching upon box-wood blocks, such as are used in wood-engraving, has been deemed a practical impossibility. We learn, however, that it has recently been accomplished in Russia, and by a method simple and ingenious. The block in its natural condition is, of course, unsuitable. The first step is to fill the pores with insoluble carbonate of copper, by means of two separate solutions, in which it is boiled sufficiently. A polish is then imparted to its surface, asphalt in solution applied to its back and sides, and finally a sensitised gelatine film placed over the polished face.

The subject to be etched is now photographed on the surface, and, by washing, the soluble and unprinted parts of the gelatine removed. A coating of asphalt is next applied to the raised parts, the blocks steeped in nitric acid of suitable strength (the stronger the better), where it remains one hour, when it is removed and subjected to the action of sulphuric acid for the same time. The

portions unprotected are thus changed to nitro-cellullose, which, by brushing, is readily removed in the form of a greenish powder. To complete the process, the block is dried, and briskly brushed with a stiff brush. The asphalt is lastly removed with benzine, and the block is ready for the press. The practical value, as to depth and retention of details, we cannot state. It is an innovation, however, that may prove worthy of attention.—*Paper and Press.*

Toning Blue Ferro-Prussiate Prints.—Prepare a solution composed of borax 70 grammes; water 1,000 grammes; add sulphuric acid in small quantities until litmus paper is slightly reddened; add a few cubic centimetres of ammonia until the alkaline reaction again appears, then place in the solution obtained 10 grammes of crude cachou, and allow to settle, stirring occasionally. To tone a print, immerse it in this bath for one minute or more, according to the tone desired. Wash in several waters, and the operation is ended. The prints submitted were toned in a cachou bath three months old. The bath had remained exposed to the air in a large open vessel. It is, therefore, certain that it will keep its qualities for a long time. For richness of tone, these prints are comparable to the best albumen prints. This result had never before been obtained.—PAUL ROY, in *Progrès Photographique.*

Converting a Print made on Eastman Paper into a Platinotype.—After development, fix, wash, and place the print face downwards in :—

Chloro-platinate of Potash	...	15 grains
Distilled Water ...	...	34 fluid ounces
Chlorhydric Acid, pure	...	3 fluid drachms

The print should remain twenty minutes in this bath, then be rapidly washed and placed in a solution of chloride of copper. By this operation the silver is converted into chloride of silver, and acquires a brown tint. Should the tone be too weak, it may be strengthened with the oxalate developing bath. All these operations may be made in diffused light. Wash well for fifteen minutes, then dry.—*Moniteur.*

To Detect Hyposulphite of Soda.—A simple test for ascertaining when the hypo. is eliminated, consists in adding to the washing water in which the prints are immersed, a small quantity of an alcoholic solution of iodine, the effect of this being to change the white back of each print to a light blue colour, which proves that hypo. is still present as the paper. The prints are continued to be washed until the blue disappears from the back of the print, and it is then known that the hypo. is completely eliminated.

Practical Hints.

A Good Disinfectant.—Dissolve half a drachm of nitrate of lead in a pint of boiling water, then dissolve two drachms of common salt in eight quarts of water, pour the two mixtures together. After the sediment has settled, the liquid is a saturate solution of chloride of lead. A cloth dipped in it and hung up in a room will purify a fetid atmosphere. It may also be used to pour down a sink, drain, or water-closet. This is very cheap, as a pound of nitrate of lead will make several barrelfuls of the disinfectant.

Damp Cellars.—If a cellar has a damp smell and cannot be thoroughly ventilated, a few trays of charcoal set around the floors, shelves, and ledges will make the air pure and sweet. If a large basketful of charcoal be placed in a damp cellar where milk is kept, there will be no danger of its becoming tainted.

Keeping Butter.—A simple mode of keeping butter in warm weather, is to invert a large crock of earthenware, or a flower-pot, if need be (varying with the size of the vessel containing the butter), over the dish or firkin in which the butter is held. The porousness of the earthenware will keep the butter cool, and all the more so if the pot be wrapped in a wet cloth, with a little water in the dish with the butter. Not the porosity of the earthenware, but the rapid absorption of heat by external evaporation, causes the butter to become hard.

Ornamenting Cabinets, etc.—A very effective style for ornamenting cabinets, windows, boxes, doors, brackets, etc., is that in which the figures of the design are relieved upon a black or coral ground, afterwards highly polished like Japanese laquer work. A preparation is first made by dissolving the best white bees'-wax in turpentine, until it is the thickness of copal varnish. For use it is to be mixed with flake white sufficient to give it a body. Now, with a fine sable pencil trace accurately the design on the white wood. When this is well dried go over the entire surface with a paint made of ivory black and parchment size, or if it is intended to give it a coral-coloured ground, use a varnish of red sealing-wax dissolved in spirit of wine. The whole work is then to be brushed hard with a bristle brush dipped in spirits of wine until the design becomes visible, appearing in sharp, clear outlines on the black or red ground. Then varnish with white varnish and rub down with pumice powder until very smooth.—*The Decorator and Furnisher.*

Stain for Ebonising Wood.—In ebonising wood it is desirable to secure the required colour without the use of any solution dissolved in water. A water stain swells the fibres of the surface of the wood, and necessitates a subsequent operation to smooth

the surface so heated. Alcohol or methylated spirits, or both combined, will effect the solution of the solid extract of the logwood, and such solution, when used in conjunction with the tincture of muriate of iron, produces a very efficient ebony dye, free from the above objections. The preferred formula is as follows:—Tincture of muriate of iron, eight parts; extract of logwood (solid), seven parts; alcohol or methylated spirit, or both combined, thirty-seven parts. The logwood and alcohol are first applied; then the tincture of the muriate of iron, which develops the jet black hue.—*The Decorator and Furnisher.*

Gold Leaf.—Gold leaf was used in the most ancient times of which we have any record. The Egyptians, as we know, ornamented with it their furniture and sarcophagi, on which the gold is still to be seen. Their gold was beaten out between the cœcum or membrane of the intestines of an ox, whilst the Greeks and Romans employed parchment. The Roman poets make occasional allusion to gilding, one comparing it to the brilliant gloss of a spider's web illuminated by the sun, another adopting the word as a synonym of the luminous vapours seen about the setting sun.

In all succeeding times the practice of beating out the leaf between parchment has never been departed from, and no device has been invented to supersede hand manipulation in bringing the leaf to a high degree. From 150,000 to 200,000 leaves make an inch in thickness. Even the rays of the sun will pass through such leaves. The tints of gold vary from a deep orange red down to a pale silvery hue. Pale gold leaf is an alloy of silver and gold; deep hues are usually intermixed with a slight amount of copper. Dutch gold is copper leaf coloured yellow by the fumes of molten zinc. Various solutions are used to alter the tint of gold leaf when laid. The best gold leaf is prepared from gold containing one and a quarter per cent. alloy of copper.

Gold with its alloys is first cast in ingots, then rolled into sheets, which are cut into squares and subjected to the hammering process on the anvil. First, the plates are extended to the size of the packs, four inches square, and again cut into four pieces, and again hammered. A third hammering is given to the pieces when they have reached the size of the pack and been subdivided. The 150 pieces with which the hammering commenced are now increased to 2,400 pieces. The process of hammering is long and tedious, and requires the nicest determination of the force, and direction of the blows. The anvil itself is convex on the top; so also is the hammer. When the sheets of metal have attained a certain thinness they are placed between prepared skin. The beater never strikes consecutively in the same place. A sense of feeling as well as of observation is

required to ascertain when the metal is sufficiently thin. During the subsequent separation and sorting of the leaves all draught has to be carefully guarded against.—*The Decorator & Furnisher.*

Answers to Queries.

385.—Fungus Growth.—It is impossible for any one to give the correct name of a fungus without having examined it. I might hazard a guess, that, perhaps, the "red points, about the size of a small pin's head on the bark of many trees," was *Nectria cinnabarina.* But if W. J. S. will send me a specimen, I shall do my best to name it. H. W. Lett, M.A.

387.—Pear-Grafting.—I have been successful, and know many others who have been the same, in grafting pear-scions on mountain-ash stock, *Pyrus aucuparia.* But the stock must have been planted for at least two years, or there will not be sufficient vigour to establish a union. H. W. Lett, M.A.

395.—Infinite Series.—A divergent series *cannot* have a finite sum, and if any method gives a finite value for such a series that method must be mathematically incorrect. In the case of the series now quoted as an example by F.S.S., the fallacy is obvious. The binomial theorem is only true *provided* the expansion either terminates or is convergent. In fact, all that is proved by the binomial theorem is this:—If the series

$$1 + nx + n(n-1) \times 2! \, x^r + \text{—ad. inf.},$$

has a definite value, that value is equal to $(1+x)^n$. Whether the series *has* such a definite value depends entirely on whether it is convergent. In the case in point the series has no finite value; therefore, the binomial theory fails, and we cannot assert that the sum of the series is equal to 1/32. G. H. B.

396.—Microscope Lamp.—There are many good and convenient forms of these lamps in the market. A very handy one is made by Baker (244, High Holborn, London), price 17s. 6d. These lamps ought to be looked upon more as luxuries than necessities, and I think J. H. will find one of the cheap forms of paraffin lamps, with about half-inch or one-inch wick, and with a burner as little elevated above the table as possible, answer all his requirements. These lamps cost about 1s. 6d.

If J. H. has not already got his $\frac{1}{6}$ inch, I should think he would be better advised to get a $\frac{1}{8}$-inch instead, as I think he will find his $\frac{1}{6}$-inch too near in working to his $\frac{1}{4}$-inch and $\frac{1}{8}$-inch of low angle (110°) are now almost as cheap as $\frac{1}{6}$-inch. For

instance, between Zeiss' $\frac{1}{6}$ (105°) and $\frac{1}{9}$ (110°) (10-inch tube) there is 13s. difference; Beck's is 25s. difference; Hartnack 8s. The reason a $\frac{1}{6}$ is so common is that short-tube (foreign) instruments have generally a $\frac{1}{2}$-inch and $\frac{1}{6}$-inch with them corresponding to the English 1-inch and $\frac{1}{4}$-inch objectives.

J. G. P. Vereker.

396.—Microscope Lamp.—It seems to me there is no more use in purchasing an elaborately-finished and expensive lamp for microscope work, than to purchase a case, beautifully finished with plated corners and handle for containing one's microscope. I think most microscopists will admit that an ordinary paraffin lamp, such as can be purchased for 1s., will answer every purpose, providing the flame of the lamp and the mirror of the microscope are parallel. My method is to place the lamp about three feet from the microscope, employing a plano-convex lens of about $2\frac{1}{2}$ inches diameter, throwing parallel rays into the plane mirror, thereby giving ample illumination when using the inch objective. Thus, for illuminating for use with the quarter inch, I either draw the lamp and lens nearer, or turn the convex side of the mirror, so as to concentrate the parallel rays coming from the lens. I think J. H. will find this illumination ample for his $\frac{1}{6}$ objective.

H. A. J.

397.—Camera Lucida.—As J. H. has a "Star" microscope, he cannot do better than procure a camera lucida as supplied by the maker of his instrument, and if economy is an object (as it generally is to most scientists), he will have no cause to complain. My own instrument is a "Star," and I have found all the accessories I have purchased to be of first-rate workmanship. H. A. J.

398.—Animal Intelligence.—Sir John Lubbock has, I believe, been carrying on a series of experiments with an intelligent dog. The animal has been taught "to read"—that is, to recognise certain written symbols by seeing them constantly associated with familiar objects. A lady some years ago taught an exceptionally bright pet dog to pick out a simple tune on the piano. But I venture to think that these and similar experiments, though carried out with admirable patience, have not been so successful as they might be, if carried out on evolutionary principles. An intelligent dog should be chosen, and carefully taught to the limit of its capacity, the utmost care being taken of the animal's bodily health, and that it should enjoy itself as naturally as possible when not under tuition. The puppies of this dog should be equally carefully trained, and so on generation after generation. The early age at which a dog breeds would enable an observer to note the progress which would be made by several generations of dogs, and I cannot help thinking the novel experiment would have a very interesting result. Animals have been bred to almost any shape, size, colour, and

weight that their breeders desire; dogs and other animals have been trained to show exceptional cleverness in assisting man, but I think no experiments have been made with a view of discovering how far the reason and intelligence of the dog can be developed *by continuing the experiments from generation to generation.* The conformation of a dog's mouth and throat would probably for ever render *human* speech impossible to him (though he can now understand language), but his advancing intellect would probably show itself in nice gradations of barks, just as the power of barking itself has only come to the dog through civilisation. The training of monkeys could also be carried on in tropical climates with the probability of like satisfactory results, the education being always carried on from generation to generation and not with isolated individuals. A. Bodington.

399.—Dry Mounting.—To give anything like a concise answer to this query would take not only the whole of the pages of this month's *Enquirer*, but the whole of the three volumes now nearly complete. I will endeavour to give just a few general rules, leaving F. R. B. to study "Davis on Mounting," 2/6, which to me seems the best book on the subject of mounting. The chief requisites are:—1st, Dryness in the object to be mounted, which in the case of botanical specimens can only be attained by being kept between blotting paper in a warm room and under moderate pressure. 2nd, I would advise the use of best gold size for ringing on cells of size only, for enclosing objects of a very thin nature, such as cuticles of plants, pollen, etc., and for fixing on cells of tin, which can be obtained of almost any thinness and diameter; then I would advise gold size again for fixing the covers. In fact, I prefer gold size in nearly every case of dry mounting as preferable to any other medium, it being less liable to crack upon letting the slide fall, as will sometimes happen to the most careful. 3rd, That the layers of gold size, whether for simple cells of size, or tin cells fixed with size, or covers fixed with this medium, each application should be permitted to dry thoroughly previous to the next application, or some dissatisfaction will be experienced by cells moving off under the slightest pressure. 4th, Few or many applications of coats of size or black varnish by the aid of the turn-table, thereby giving the slides a finished appearance. In conclusion, I would warn amateurs against the so-called quick method of dry mounting, for one's own common sense will tell him that quick mounted or dried specimens do not give the satisfaction which those give that have received careful manipulation in drying and preparing, even if done slowly. H. A. J.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place when more than one question or answer is sent by the same correspondent. Each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply. All answers should be sent to the Editor, 1 Cambridge Place, Bath, and must reach him before the 12th of the month.

407.—Rule Wanted.—Will some correspondent tell me if there is a rule in ordinary arithmetic for answering such a sum as the following:—The offertory at a certain church amounted to £167 1s. 8d., and consisted of 1,604 pieces of money; £5 notes (one or more), and coins, representing each of the following values:—£5, £1, 10/-, 5/, 2/6, 2/-, 1/-, 6d., 3d. and 1d. How many of each value were there? Please note that I desire to answer it by common arithmetic, and not by algebra. PUZZLED

408.—Carduus Nutans.—Walking in the country the other day with my son, we picked a specimen of the "Nodding thistle" (*Carduus Nutans*), and upon smelling it we found it was beautifully perfumed. Some few minutes afterwards, my son complained of a severe stinging in the upper part of the nostril, accompanied by closing of the eye and severe aching of the teeth, on the side of the face stung. Upon examining the flower, we found the bulb under the calyx to be tenanted with a colony of small insects. Can any reader give me a diagnosis of the attack of pain, etc., and the name and other particulars of the insects which use the above-named thistle for their habitat? O B.

409.—Another Rule Wanted.—I have never met with a problem in any arithmetical work like the following, but feel sure a rule in simple arithmetic ought to answer it:—A long rod is divided into two unequal portions, the length of the shorter piece is 28 ft. If you add $\frac{3}{11}$ of the longer piece to the shorter, and to this further add $\frac{1}{14}$ of the remainder, the short piece with the two added lengths will measure $\frac{3}{7}$ of the whole. What was the length of the entire rod? PUZZLED.

410.—Absence of Birds.—I am informed that near Goodwood there is a wood named the "Birdless" Grove or Wood, because it is not frequented by birds. Can any reader state that such is a fact, and if so, why is it so tenantless of such attractive visitors? R. H. M.

411.—Lamp-Chimneys.—Has the relation between the lamp chimney and the flame ever been made the subject of scientific investigation, so as to secure perfect combustion for any sized flame by some formula? W.

412.—Curling of Paper.—What is the reason why a hair or a strip of paper will curl up when drawn swiftly between the nails of a finger and thumb? H. D. P.

413.—Opacity.—The hard parts of insects when bleached in chlorine gas become white, but very opaque. How can this opacity be got rid of? R. S. P.

414.—Forming Cells.—How can I make holes in glass for the purpose of forming cells by cementing the glass with the hole in it on to the ordinary slide? Z. S.

Reviews.

An Introduction to the Science and Practice of Photography. By Chapman Jones, F.I.C., F.C.S., etc. Crown 8vo, pp. 278. (London: Iliffe and Sons. 1888.) Price 2s. 6d.

In a revised and enlarged form the author gives us a course of lectures delivered at the Birkbeck Institution. They treat very fully of the Application of Photography and the History of its Development; The Chemical Action of Light, etc. etc.; of Apparatus; and of the various Processes, to which no fewer than 20 chapters are devoted. A useful Appendix is added on Testing Lenses, English Weights and Measures, Comparison of the English with the Metrical System, and Comparison of Fahrenheit and Centigrade Thermometers. This forms a valuable acquisition to our library of photographic works.

The Photographer's Note-Book and Index, with Tables of Exposure and Rules. By David Solomons. (London: Marion and Co.) Price 1s.

This is one of the most useful pocket note-books for the photographer which we have met with, and we should think that no photographer could afford to be without it.

Annuaire de l'Observatoire Municipal de Montsouris pour l'An. 1888: Meteorologie, Chimie, Micrographie, Applications a l'Hygiene. (Paris: Gauthiers-Villars.)

This is the annual statement of meteorological and other work performed at the observatory of Montsouris, under the auspices of the Municipality of Paris. Full descriptions of the instruments used, together with illustrative woodcuts, are given. Besides the usual routine work of an institution of this character, the observatory daily analyses the air and water supply of Paris. The methods used are given *in extenso* in a paper on the detection of microscopical organisms in air and water.

PROCEDES PHOTOGRAPHIQUES aux Couleurs d'Aniline, Application sur Vitraux, sur Nachre, et sur Ivorie. Par Geymet. Crown 8vo, pp. 107. (Paris: Gauthier-Villars et Fils. 1888.)

In this treatise Mons. Geymet has given us an interesting account of his experiments with the aniline colours, as tints for photographs, on glass, ivory, and pearl shell. He points out that these materials may be tinted with aniline colours, and then photographs placed on them, by means of a sensitive coating of bitumen or chromate-gelatine.

L'ART DE RETOUCHER en Noir, Les Epreuves Positives sur papier. Par C. Klary. Cr. 8vo, pp. 32.

TRAITE PRATIQUE D'IMPRESSION PHOTOGRAPHIQUE, sur Papier Albumine. Par C. Klary. Crown 8vo, pp. 132.

TRAITE PRATIQUE DE LA PEINTURE DES EPREUVES PHOTOGRAPHIQUES, avec les Couleurs a l'Aquarelle et a l'Huile, suivi de different, Procedes de Peinture Appliques aux Photographies. Par C. Klary. Cr. 8vo, pp. 153.

L'ART DE RETOUCHER les Negatifs Photographiques. Par C. Klary. Crown 8vo, pp. 86.

(Paris: Gauthier-Villars. 1888.)

In these four treatises, Mons. Klary has, we should think, almost exhausted the art of retouchment—and that it is an art, we think no reasonable person will deny. The photograph, pure and simple, may give an exact representation of your friend as he was at the time when the negative was exposed, but it is probable that his expression at that moment was not what he usually wears. In fact, it may be a caricature, though the result of a process that does not admit of misrepresentation. We do not want a portrait of our friend in one phase only of his expression, and the clever artist knows how to soften this or that feature which is too harsh or too prominent, and to give us a portrait that more nearly represents the man as a whole, not so much what he is at any particular moment, but as his friends know him in the ordinary intercourse of life. At the conclusion of his last treatise, Mons. Klary gives us an amusing account of the claims that the public make on the photographic artists. He seems to think that all classes, whatever be their professions, like to be flattered, and that if the photographer is to be successful he must know how to do this skilfully.

PROCEDES DE REPRODUCTION DES DESIGNS, par la Lumiere. Par R. Colson. Crown 8vo, pp. 29.

We have here instructions for the reproduction of drawings by the action of light. Only those processes are described which are employed when no alteration of scale is required, but explicit formulæ and directions are given for sensitising the paper with the salts of iron and bichromate of potash, the latter giving a print of greater permanence than the iron papers.

TRAITE PRATIQUE DE PHOTO-MINIATURE, Photo-Peinture, et Photo-Aquarelle. Par A. Simons. Crown 8vo, pp. 44. (Paris: Gauthier-Villars. 1888.)

This little work gives instructions for transforming photographs into pictures having the appearance of paintings, thus giving a more pleasing "counterfeit presentment" of real life. The method is very concisely described, the author especially recommending the "Photo-aquarella" method, on account of it giving a very close imitation of oil-painting, even when water-colours are employed.

The Scientific Enquirer.

OCTOBER, 1888.

*The Salt Industry in Cheshire.**

By Lucy E. Boole.

Part II.

I WILL now give a short account of the works. The brine, as it springs up through the holes, contains from 25 to 27 per cent. of salt, and of this salt about 98 per cent. is pure sodium chloride, the only impurities being from 1—1½ per cent. of $CaSO_4$, and a trace of $MgCl_2$. Sometimes water will get in from shafts, causing the brine to become weaker. As it will not rise spontaneously to within 60 yards of the surface, it has to be pumped up into a great reservoir. It is noticed that every week, after the pumps have been at rest for Sunday, the brine rises in the shaft. The reservoir is connected by pipes with large evaporating pans, which can be filled as required. These pans are on the average 50 to 60 ft. long by 25 ft. wide, and 2 ft. deep, They are made of iron, or in most cases now of steel plates, riveted together, each plate being 2 ft. by 9 ft. and from ¼ to ⅜ in. thick.

The pans are set up on brick and iron-work, and underneath each pan are four furnaces, which are kept alight night and day while the pans are in use. The furnaces are fed with small slack coal brought from the adjacent counties. The $CaSO_4$, of which, as I said, the brine contains a small quantity, being so very slightly soluble in water (only 1 in 500), precipitates as soon as evaporation begins, thus purifying the salt. This, however, creates one great difficulty in connection with the pans. In spite of all the care that may be taken, a part of this will adhere firmly to the bottom of the pan, the result being that the pan very soon gets burnt. From this cause each pan requires large repairs about every three months, and when this takes place the furnaces have of course to be let out, and the pans emptied and raised bodily up from the brick-work in order to rivet new plates on. This is natu-

* From *The Pharmaceutical Journal.*

rally a very expensive operation, the average cost for the mending of one pan alone being from £30 to £40 per year.

The pans are arranged in rows, with platforms running down between them on a level with the top edge of the pan. The platform is separated from the pan by a trough. The steam is so dense that as one stands on the platform one can scarcely see to the other side of the pan. As evaporation proceeds, the salt crystallises out on the top of the brine, looking very much like a thick layer of snow gathering there, which sinks to the bottom as the crystals increase in weight. Men stand in the troughs with long rakes and ladles, and when a good solid layer has formed on the top they rake it off over the edge. The difference in the grain of various kinds of salt is due to the different temperatures the brine is allowed to reach. In pans kept at 100° F., the salt produced is of a very coarse grain. It is drawn from the pans once a week, or if very coarse grain is wanted only once in two or three weeks. It is called fishery salt, and is used for curing fish in Great Britain and Norway. In pans kept at 160° to 190° F., coarse common salt is produced. This is taken from the pans once every twenty-eight hours, and is used for chemical processes and alkali works. It is sent to America and other parts of the world.

At boiling point fine salt is produced, and this is the kind I suppose we are all most familiar with. It is taken from the pans two or three times every twenty-four hours, and then either shipped as it is or made into blocks, in which form we buy it for table. To get it into these blocks, it is packed while damp from the pan into long-shaped boxes, each holding about 28 lbs. of salt. After lying in these for an hour it is sufficiently cohesive to be turned out and still keep the shape of the box. This is done, and the damp blocks are then put into a hot chamber for a week, being kept at a temperature of 90° to 110°. The blocks are sent largely to America for curing meat, for the salt there contains $MgCl_2$, which spoils meat; but the loose, fine salt is shipped mostly to India and Burmah, nearly half a million tons going annually. The amount produced from each pan making common coarse salt is 40 to 50 tons per week, and from the fine salt pans 25 to 35 tons. The quantity of coal consumed in the furnaces for making 1 ton of coarse salt is 11 cwt., and for 1 ton of fine salt about 14 cwt.

Various methods have been tried to cheapen and simplify the process of evaporating, but so far nothing has been found to supersede the present arrangements—namely, the plain, open, evaporating pans and the very cheap slack coal, which costs at the works only 5s. per ton. M. Weibel, the great French engineer, visited in 1882 some of the Cheshire works, and he was of the opinion that nothing could be better than the present plans. He had invented and put into use in France a highly complex system of

triple boilers and vacuum evaporation; but in France fuel is dear, and salt is also at the high prices maintained by heavy protective duties on foreign salts. It has been calculated that altogether in Cheshire there are one and a half million square feet of ground covered by pans alone, or considerably over 34 acres.

This is about all I can say of the brine works, but I have yet to describe the mine. I do not know whether there is anyone who really enjoys the process of descending a mine; if so, I should be glad to be able to enter into that person's feelings. For my own part, I must say that, to stand in a small bucket in pitch darkness and be let down 160 yards under the earth by a hole so narrow that you expect your arms to be left behind if you move them from your sides, is anything but an agreeable sensation. This, however, is a small matter, and quite worth enduring for the sake of seeing the mine. The top part of the shaft—*i.e.*, the part through the marlstone layer—has to be boarded round to prevent stones and earth falling in. If a miner should stand under the shaft and even a very small stone fall on his head, it would kill him from the rapidity of its fall towards the bottom. The men are forbidden to stand under the shaft, and, while actually going up and down, are protected by a canopy fixed over the bucket.

I was formerly under the impression that all salt mines are beautiful places, with natural caves, arches, and pillars of pure white. But I was labouring under a great delusion, for such mines do not exist in England. Some, indeed, are not rock salt at all, but are formed by the dropping down of natural brine which deposits stalactites. The English rock salt mine is not particularly beautiful, unless lighted up enough to make the walls reflect. It is one vast chamber, the walls, roof and floor of which are solid rock salt, just like those specimens upon the table, only that in such large quantities, it looks like a dirty discoloured mass. It varies as you see from pink to a dull brownish colour, the latter being the most common. The colour is due to iron, which is present in the form of peroxide and also a little persulphate.

Here and there, though not very often, are found perfectly pure colourless pieces, which show the cubical form of the crystal of salt. Every 25 yards huge square pillars are left standing, 12 yards in width, in order to support the roof. In the old mines of the top stratum, no pillars, or only very small ones, were left, and that is why the land is falling in to them.

The only light is that given by very small tallow candles; each miner carrying one and sticking it with a lump of clay on the ground or on a ledge of salt in the wall when he is working. In one mine they burn from four to five tons of candles in a year.

In spite of the great number burning at once it seemed to me extremely dark, and though I carried one myself I very often

nearly fell over loose piles of salt that I could not see. The miners, however, get quite accustomed to the darkness, and say they can see perfectly well.

The mine is generally from 18 to 30 feet high. The salt is got off either by pickaxes or else by blasting, chiefly the latter, one blast usually dislodging from one to three tons, though sometimes no less than fifteen tons. The noise of a blast is something tremendous, and the vibration so great that it seems as if the whole mine were going to fall in. The echoes roll round like thunder.

The difficulty of ventilation, about which we hear so much in the case of coal mines, does not occur here, from there being no gases generated by the salt, and also from the mine being one large chamber; for the rock salt lies in a continuous bed, and does not, so far as the miners have tried it, run in narrow veins. The only passage for air is down the shafts, and yet the mine seems perfectly fresh. One shaft has an up draught and the other a down draught, each always keeping the same direction. No brine ever comes into these lower mines, as it is only running over the upper salt stratum. The temperature never alters summer or winter, always keeping about 52° F. The salt is carried to the shaft by trucks that run on lines laid along the floor. It is then wound up the shaft in a bucket, and if it is to be ground on the premises the bucket is tilted over into a slanting trough, down which it shoots the salt into a large machine very much like a coffee mill.

What is not ground is sent away in lumps, to the lighters, which carry it down the Weaver and Mersey to Liverpool, whence it is shipped for Denmark, Holland, and other countries where foreign white salt is prohibited, or under too heavy duty. In these places it is made into brine, and white salt got from that. The lumps are also used for cattle to lick and for salting hides. The chief use of rock salt now, besides the alkali manufacture, is in the great process started fifteen years ago of reducing copper ore, which has made copper and brass articles so much cheaper and more plentiful than formerly.

As salt is such an indispensable article, it is comforting to know that there is practically no danger connected with procuring it. Accidents very seldom occur, and when they do, they nearly always arise from carelessness on the part of the workmen. If a man drops a lighted match into gunpowder or anything else of that kind, the consequences are naturally serious. Occasionally a man falls into a pan of scalding-hot brine; but this happens either from extreme carelessness or else from his not being quite sober. While I was looking at the pans a man came up to say that the day before another man had fallen in in rather a curious manner. He

had actually stood his spade upright by the edge of the pan and sat on the handle with his legs stretched out on the platform in front of him. The spade slipped and the man fell backwards into the brine. Our informant, who fully appreciated the utter carelessness of such a proceeding, was not content with telling us about it, but would insist upon illustrating it, although we assured him that we quite understood, and would very much rather not see a second edition of it.

The rock salt mined averages 200,000 tons a year.

The total quantity of white salt made is 1,500,000 tons on the average. Of this 500,000 is used at home, and the other 1,000,000 is shipped at Liverpool to all parts of the world.

Short Papers and Notes.

Explosive Witch-hazel Pods.

SOME time ago, says a writer in a contemporary, being desirous of testing the shooting powers of the witch-hazel pods (*Hamamelis*), to ascertain the distance covered by the flight of the seeds, I brought home several of the branches, as well as a pocketful of the nuts. My experiments with the latter upon a piazza and elsewhere proved to a demonstration that the momentum of the seed would commonly carry it to a distance of twenty feet, often over thirty feet, and in one or two instances the diminutive, double-barrelled howitzers succeeded in propelling their missiles to the distance of forty-five feet by actual measurement. I placed the bough, well laden with the nuts, over a picture in my room and retired, but I might as well have sought sleep in pandemonium. The incessant clatter upon ceiling, wall, and furniture forced me at length to drop the offending branch out of the window. A large paste-board box, containing a pint or more of the loose pods, kept up such a continual spiteful tattoo that these had also to follow their fellows, and several of my friends to whom I had presented sprigs of the festive shrub told me on the following morning that they had been obliged to give them separate apartments.

How Telegraph-Poles are Preserved in Norway.

Telegraph-poles are preserved in Norway by making an auger-hole about a foot from the ground, in which four or five ounces of

sulphate of copper in coarse crystals are placed and plugged in. The chemical is gradually absorbed by the wood until its whole outer surface turns of a greenish hue. The sulphate requires an occasional renewal, and is said to be a perfect preservative.

Languages.

The Chinese language is spoken by four hundred million persons; Hindostani by upwards of one hundred million; English by more than one hundred million; Russian by more than seventy million; German by fifty-eight million; Spanish by forty-eight million; and French by forty million.

The Lesser Spearwort.

Several horses and other animals in Bedfordshire have been poisoned by eating, it is supposed, the Lesser Spearwort (*Ranunculus flammula*), a very poisonous variety of the Crowfoot. This plant is usually uncommon, but the excessive wet season seems to have been favourable to its development.

Drying Plants in their Natural Colours.

Dr. Schonland gives in an Indian paper the details of his system of drying flowers:—"Take two pints of a saturated solution of sulphurous acid in water (which can be had at any chemist's and is very cheap if bought in large quantities); add to this one pint of methylated spirit. Keep this mixture in a wide-mouthed bottle, which should be so tightly closed that the contents do not evaporate when not in use. Leave ordinary flowers in this mixture for about ten to twenty minutes; inflorescences of *Bromeliaceæ* and *Aroideæ* must be left in it about an hour. In most cases the colour will completely disappear, but it will gradually return during the process of drying, or even after the plants have become apparently quite dry. Having treated the specimens with the mixture for a short time, as stated above, take them out and shake off the adhering drops of fluid. Leave the plants in a dry, warm place in order to dry them superficially (they must not be allowed to shrivel), and then dry them in the usual way between blotting-paper. If artificial heat is used in the latter part of the process, excellent results are obtained, and it is not even necessary to change the drying-paper. If hot-water pipes are available, it is very convenient to place on them the bundle containing the plant to be dried, which need not be subjected to very great pressure. As it is sometimes difficult to prevent flowers from collapsing when using this method of preservation, and as often it is almost impossible to spread out the

flowers when they have collapsed, I often put them loosely between sheets of vegetable parchment before immersing them in the fluid."

A Minute.

In a minute, we shall be whirled around on the outside of the earth, by its diurnal motion, a distance of fifteen miles. At the same time, we shall have gone with the earth in its grand journey around the sun 1,040 miles.

In a minute, a ray of light travels 11,160,000 miles.

In a minute, over all the world, about 80 new-born infants have each raised a wail of protest at the fates for thrusting existence upon them, while as many more human beings, weary with the struggles of life, have opened their lips to utter their last sigh.

In a minute, the lowest sound we can hear has been made by 990 vibrations, while the highest tones reach us after making 2,228,000 vibrations.

In a minute, an express train will travel a mile, and an average pedestrian will have got over 16 rods.

A Sagacious Horse.

A remarkable case of the sagacity of the horse is reported from Gillot Road, Edgbaston. A man, named Nathan Gilbey, a coal-dealer and hauler, rents a field there, in which a horse and goat have been in the habit of grazing. Recently, a gang of young roughs from the Icknield Port Road, have amused themselves by throwing stones at the goat, and some of the more cowardly ruffians beat it with a stick. Whenever the goat has been attacked in this way, the horse has always raced to its rescue, and a few days ago he seized the young rascal by the coat-collar, and flung him clean over the hedge into the road.

A Large Meteorite.

The Bendigo meteorite—a mighty mass of meteoric iron—has been transported to Rio de Janeiro, and is now in the Brazilian National Museum. It has lain in the Bendigo Creek since 1785, and has been written about again and again by travellers and men of science. The removal of this famous meteorite was not possible until the completion of the railway to within seventy-two miles of Bendigo Creek, and even then it had to be transported over trackless hills and dales. Many believed the Bendigo meteorite to weigh about nine tons. Its actual weight is now

found to be about six tons. It is a "mighty lump," truly, and yet it is altogether eclipsed by the mass of meteoric iron found in 1870 by Nordenskiold in West Greenland, which weighed twenty-two and a-half tons.

Vegetable Glue.

A concentrated solution of gum arabic possesses the disagreeable property, when applied to printing and other paper not strongly sized, of penetrating them to transparency, and in spite of this, not making them adhere to other paper. Paper cannot be attached to common pasteboard nor wood to wood by it.

Paper gummed with mucilage will not adhere to metallic surfaces, but soon falls off, and it is useless for glass, porcelain, or earthenware. All these disadvantages are remedied when an aqueous solution of sulphate of aluminium is added.

For 250 grains of the concentrated gum solution (prepared with two parts of gum and five of water), two grains of crystal aluminium sulphate will suffice. This salt is dissolved in ten times its quantity of water and mixed directly with the mucilage, which in this condition may be termed vegetable glue. Solution of alum serves the same purpose, but far less efficiently.

Fruit as Food and Medicine.

For more reasons than one, fruit ought to be regarded not only as a sound nourishment, but also as a curative agent. Its influence upon the human body has not been sufficiently acknowledged. This is a mistake, because we are really able, with the simple help of fruit, to alleviate or to entirely eradicate all the evils to which our miserable bodies are accustomed. A fact well known to science is that people of robust constitution who eat good fruit in moderation live to a very advanced age. In spite of this, one ought to know what part of the fruit should be carefully avoided. Do not swallow the rind of peaches and apples, the stones of cherries and apricots, or the pips of oranges and lemons. These insoluble substances form a weight upon the stomach, and sometimes bring about serious trouble in the intestines. Throw away the "skin" of the grape as well as that of the orange. It is only the pulpy part of any fruit when it is fully developed that is an excellent nourishment, but take it as a continual food, not simply as a dessert. Prunes, cherries, and grapes are not so easy to digest as peaches, which contain a good proportion of the elements in solution. They ought also to be recommended in case of weak stomach. With your fruit eat bread, and preferably stale bread, because it cleans the tongue, and enables you to taste the flavour of the fruit with more advantage.—*Moniteur d'Horticulture.*

Photographic Notes.

How to Make Ground-Glass.—Breaking the ground-glass is an accident not very easily remedied in a small country village where a new one cannot be procured. This is how I made one :—

I bought five cents. worth of emery and two pieces of glass of the size required. Spoiled negatives will answer if they are cleaned, which can be done with a strong solution of lye. I placed one of the glasses on a flat board, and sprinkled a small quantity of the emery on it, which I wet with water. Placing the other glass on that, I ground them together, renewing the emery and water whenever necessary. In about an hour, I had two of the finest quality of ground-glass fully as good as those I would have to pay seventy-five cents. for (size, 8 in. by 7 in.) The emery may be carried by the amateur much easier than an extra ground-glass.—*Scientific American.*

Glass for Dark-Room Windows.—M. Scola has been trying a variety of experimental stains for the glass of dark-room windows, and has fixed upon the following formula :—

Water	...	..	... 100 c.c.
Gelatine	...	...	... 5 grammes.
Nitrate of Silver		...	... 1 gramme.

Glass coated with this solution is exposed to light until it assumes a reddish-brown tint. It is then washed to eliminate the nitrate of silver. A surface is thus obtained through which the actinic rays do not pass. The colouration may be deepened by increasing the proportion of nitrate of silver up to 3 or even 4 grammes. Glass tinted in this way may also be used to shade the dark-room lantern.

Practical Hints.

Violet Copying-Ink.—The following receipt is given for making violet copying-ink :—Dissolve 40 parts of extract of log-wood, 5 of oxalic acid, and 30 of sulphate of aluminium, without heat, in 800 parts of distilled water, and set aside for 24 hours. Next, raise the temperature to boiling-point in a bright copper boiler, and mix with it, while hot, 50 parts of wood vinegar. When cold, bottle it, and after a fortnight decant the liquid from the sediment. It writes a dark violet, and furnishes a bluish-violet copy.

Red Copying-Ink.– Dissolve 50 parts of extract of logwood with 750 parts of distilled water in a mortar and without the application of heat. Add 2 parts of chromate of potassium, and set aside for 24 hours. Then add a solution of 3 parts of oxalic acid, 20 parts of oxalate of ammonium, and 40 parts of sulphate of aluminium, in 200 parts of distilled water, and again set aside for 24 hours. Boil in a bright copper vessel, add 50 parts of vinegar, and after cooling bottle it; cork well. After a fortnight decant the clear liquid. The ink writes well, gives brownish copies, and turns darker on the paper.

A Good Mucilage.—Take 400 parts of dextrine and stir into 400 parts of water, then add 200 parts *more* water. To this add 20 parts glucose, 10 parts aluminium sulphate. Heat the mixture to 195° F. Then the mixture becomes thin and transparent.

V. A. LATHAM.

Preservative for Books.—Vaseline, well rubbed in, prevents the leather from cracking and rubbing, and it preserves calf, morocco leather, and cloth, also marbled and gold edges, but not so well. V. A. L.

Answers to Queries.

359.—Thorax.—I have a transverse section of foetal thorax, showing spinal cord, lungs, liver, and adjacent parts *in situ*. It was prepared as follows:—Transfer the portion to be cut from 75 per cent. alcohol to absolute for several weeks; then into absolute alcohol and sulphuric ether, equal parts, for a few days; then to a moderately thin solution of celloidin in equal parts of absolute alcohol and ether, remaining tightly corked up for several months; then into a thicker solution of celloidin for a few weeks; then hardened and cut in the usual manner for celloidin preparations. Stain sections in borax carmine, put into 95 per cent. alcohol, cleaned by dipping a few moments into common commercial carbolic acid, which serves an excellent purpose, and will rapidly clean a section taken from 80 per cent. alcohol, so that it will mount clear in balsam without affecting the celloidin which holds the parts in place. By the use of celloidin, one can mount sections of flowers, ovaries, etc., with every part *in situ*. V. A. L.

395.—Infinite Series.—In my reference to the Binomial Theorem (p. 175), two errors occurred in the printing of the third term. It should have been: $n\,(n-1)\,x^2/2\,!$. The index 2 was misprinted r, and the solidus, or symbol of division (!), misinterpreted as one of multiplication. The note of admiration after a symbol, such as 2 !, 3 !, *n* !, etc., stands for "factorial" 2, 3, or *n*,

as the case may be, being much more easily printed than the old-fashioned ∫2. G. H. Bryan.

396.—Microscope Lamp.—The source of light in microscopic investigation is very important. The worst of all ordinary forms of artificial illumination is coal-gas; and the best, at least in my experience, is petroleum containing camphor in solution and colza oil occupying an intermediate place between the two. In using a lamp, *no direct rays* should find their way into the *eye* of the observer except through the tube of the microscope. Next, exclude the red rays of the light from the eye. I do not think that any very great advantage is obtained by getting an expensive lamp. I have used a small household lamp, with a blue glass and a white (thick) paper shade over it, taking care to put a lump of camphor in the oil as above. The lamp I now use, and which in my opinion is everything to be desired, is "Parkes," with *cooling* evaporator. It has a hood, at the back of which is a parabolic reflector, transmitting nearly parallel rays and removable for cleaning purposes, etc. At the front is a "light-modifier." In this way work may be done and no heat worth mentioning is felt by the student, which is greatly to be desired. It may be bought of Ferris and Co., Bristol, for about a sovereign at the most. I am not sure if it is not even less. It is made to be useful for all purposes, and is constructed of brass. Swift's lamp is good, but would be much improved by a glazed porcelain chimney with two opposite perforations, so as to avoid all extraneous rays passing to the eye. Browning's lamp is very good, as are Collins' Bockett and Fiddian's lamp, made by Ross and Co. A beautiful lamp is that made by Wood and Co., Liverpool, for Messrs. Dallinger and Drysdale. A good, cheap, little lamp is Barclay's "Mikros," of 138 Regent Street, London (12/6), which is furnished with a silvered reflector and a powerful lens. It burns for seven hours without replenishing, at a cost of one-eighth of a penny per hour, and gives off very little heat. The German student's lamp is good and cheap, and has an Argand burner. For books on the subject, see Carpenter, Hogg, April number *Monthly Microscopical Journal*, 1876, Vol. XV., *Journ. Royal Microscopical Society*, *Journal Quekett Club*, Vol. I., second series; "On Microscopical Vision," Nelson and Suffolk; and Gage "On Microscopical Methods" (50c.). V. A. L.

397.—Camera Lucida.—The vertical camera lucida (Beck's, 18/-) is a good one, and is used in an upright position, and is in other respects similar to Wollaston's (horizontal, 10/-). A small one may be made by using a cover-glass (white or blue), held at an angle of 45 deg., with the eye-glass in such a position that the centre of the cover coincides with the optical axis of the micro-

scope, but the microscope has to be inclined. The one I have has been in use over 4 years, and only cost me 3/6. I find it quite as good as a more elaborate one. Beale's neutral tint reflector is a cheap, useful piece of apparatus (5/-). I do not think that it makes very much difference which position the camera lucida is used in. The ones *most* common in use are horizontal. Chevalier's is a good instrument, as are Zeiss' and Nachet's. One thing must be remembered. They are in many cases more useful for giving the actual size of an object as seen with a certain combination of lenses, and for giving the general outline of a section than for the individual details. (See *Scientific Enquirer*, Vol. I., 1886, p. 68.) V. A. L.

397.—Camera Lucida—The cheapest form of camera lucida I know of, and which I have used a good deal, is Dr. Beale's neutral-tint reflector. It ought to be made of a metal tube, with a piece of thin neutral-tint glass placed at the end at an angle of 45°. It is very easy to use so long as there is not too strong a light on the paper, and costs 5s. to 6s. The objection to this and Wollaston's camera is that the microscope must be put in a horizontal position before using them, thus altering the illumination. For this reason I prefer the vertical camera, as then the drawing-paper is placed parallel to the stage, and I have lately bought Abbé's—(this costs, I think, two pounds)—and is a very good instrument. Zeiss, however, makes another form, price 21s., and Beck makes a vertical camera lucida, price 18s.

The external diameter of Zeiss' oculars is 23·3 mm. (=·917 inch), and the Abbé camera is capable of adjustment within certain limits, so it might fit J. H.'s oculars; on the other hand, the mirror makes it rather heavy. J. G. P. Vereker.

398.—Animal Intelligence.—I would advise the enquirer to read Dr. Carl Semper's "Animals and their Conditions of Existence" and Prof. G. J. Romane's "Animal Intelligence," both of the International Scientific Series (Kegan Paul and Co.), and papers in *Science Gossip*. V. A. L.

399.—Dry Mounting.—For a quick and simple method, see *Journal of Microscopy and Natural Science*, Vol. IV., p. 27. I prefer to use a metal cell, to be careful to have *dry* objects, and use *very*, very little gum on any specimen which is not large enough to fill the cell, and having got rid of the moisture from the gum, etc., seal up the cell. Two plans may be used to close the slide. One is to cut a groove in the metal cell to allow of the escape of vapour, and then stop up the orifice at some later period. The other is to have the cover-glass so small that it will only just rest on the inside edge of the cell, and allow all but a very small portion of the cement to be exposed for evaporation.

I mount an object in the cell, let it dry thoroughly, place the slide on the turn-table, spin a ring of brown cement (Ward's) upon the cell, allow to dry till it can be indented with the finger-nail without sticking. Warm a cover-glass and place it on the cell. Take a *strong* glass slip, make it hot in the centre with a spirit-lamp, and press it down on the top of the cover-glass. The warm melts the cement, and the cover is firmly fixed without evaporation inside the cell. Put the slide aside for a day or two to harden, and then add another layer or two of cement, and the dry mount is safe. If very shallow cells are used, brown-cement cells, which are allowed to get thoroughly dry and hard, are best. But before fastening on the cover glass, apply a second coat of the cement, and when this is just getting hard apply the heated slide as above. If opaque objects are wanted, the light may be turned off or a background used. Some very dark-coloured objects want a white ground; then use white opal slips. A blue ground may be obtained by covering the bottom of the cell with fine powder-blue paper, and over both fasten a cover-glass. This forms a base upon which to place your true cell, and in which you wish to mount your object. It will be seen the coloured paper is out of focus when the object is looked at, yet the desired tint is obtained and is very cool and pleasant to the eye. Carbolized gum, to which add a few drops of glycerine, is good to hold objects in place, and is not brittle. V. A. L.

400.—Abbe Microscope Condenser.—In reply to B. R. F., I may say that I have used one of these for some time, though I believe mine is not of quite so high angle as Zeiss' present form. The condenser is certainly a very convenient one and of easy use; and replaces diaphragm and mirror and the ordinary illuminating arrangements. If the condenser gives too strong a light I remove it and use the stops instead of a diaphragm. I have had a ground glass diaphragm and one with slits at right angles fitted to mine, with advantage I think. Experimental stops of blackened cardboard are easily applied.

As for dark ground illumination, with 600 diameters, this must depend very much upon the angular aperture of the lens. With a lens of 75° like Zeiss', D ($\frac{1}{6}''$) it will give it with large angles; the oblique rays enter the objective. I have not a polariscope adapted to mine, so am unable to speak of its performance in that way. The chief objection to it is its weight and size. It is arranged so as to form substage arrangements for Zeiss' larger stands; Leith also, I believe, adapts the same kind of condenser on to his stands. Baker makes a simpler and lighter form of the above for some of his stands. This form gives central light and dark ground illumination; oblique light must be obtained by special diaphragms and not by rack and pinion movement as in Zeiss'

form. I have just had my condenser lens mounted this way for another instrument, and so far as I can see it works well. The price of these condensers is for Zeiss' stands 55/-; for the English stand to fit in the substage 65/-; and Baker's simple form of mounting £2 to £3. For further information I must refer B. R. F. either to Carl Zeiss, Jena, or to his London agent, Mr. C. Baker, 244 High Holborn, London. J. G. P. VEREKER.

402.—Odontomes.—I believe Canada balsam or dammar, if used nearly hard, as in the manner for bone and teeth sections, is the best medium in which to mount odontomes and also fœtal skin. V. A. L.

407.—Rule Wanted.—There can be no rule for answering such a question as that put by "Puzzled." There may be, perhaps, a hundred different ways in which a sum of money such as £167 odd could be made up of 1,604 coins, etc. For example, take some florins, shillings, and sixpences. There are six different ways in which a guinea could be paid in 21 coins, using some of each :—

Florins.		Shillings.		Sixpences.
1	...	18	...	2
2	...	15	...	4
3	...	12	...	6
4	...	9	...	8
5	...	6	...	10
6	...	3	...	12

If a guinea has six different ways of being made up, the probability is that £167 could be paid away in a still greater number of ways. The only method of solving such puzzles is by the "tentative" process, vulgarly known as the "rule of thumb." M. A. I.

407.—Rule Wanted.

PENCE.	A	B	C	D	E	F	G	H	I	J	K
1200	$\frac{1}{1175}$	...	...	...	...	1	...	...	...	...	1
240	...	$\frac{1}{215}$	...	...	...	...	13	...	...	...	13
120	...	...	$\frac{1}{95}$	...	...	...	...	19	...	..	19
60	...	...	...	$\frac{1}{35}$	...	..	...	...	22	...	22
30	...	...	...	...	$\frac{1}{5}$	...	...	...	...	24	24
24	1	...	...	...	...	1175	...	...	...	...	1175
12	...	$\frac{1}{13}$	...	...	...	...	215	...	...	...	215
6	...	...	$\frac{1}{19}$	...	...	...	...	95	..	...	95
3	...	...	...	$\frac{1}{22}$	...	...	...	...	35	...	35
1	...	...	...	...	$\frac{1}{24}$	...	...	...	...	5	5
											1604

The principle upon which the solution of such problems as the one under consideration is based is that of balancing every gain by a corresponding loss. And for the sake of argument let us suppose we buy 1,604 articles for £167 1s. 8d., some at £5, etc. The average cost of each is 25 pence. We will reduce all the cost prices to pence. If an article worth 1,200 pence is bought for 25 pence, there is a gain of 1,175 pence; hence, in order to gain one penny, I must buy $\frac{1}{1175}$ of that article (see column A). Now, as I have gained one penny, I must balance this by a loss of one penny. So if I pay 25 pence for an article worth 24 pence, I lose one penny (column A). Similarly, I find that every time I buy one article at 240 pence, I must buy $\frac{1}{13}$ of an article at 12 pence (column B); or one article at 120 pence, I must buy $\frac{1}{19}$ of one at 6 pence (column C); or one article at 60 pence, I must buy $\frac{1}{22}$ of one at 3 pence (column D); or one article at 30 pence, I must buy $\frac{1}{24}$ of one at 1 penny (column E). Since fractions having a common denominator are to each other as their respective numerators, I find the common denominators to each of the fractions to be 1175, and place the numerators in columns F, G, H, I, J, and in adding up these columns they give the required number. The only rule for the solution of these problems that I know of is given in Brooks's arithmetic under the title "Alligation."

Philadelphia, Pa. C. HENRY KAIN.

409.—Another Rule Wanted.—It is a misconception of the scope of "simple arithmetic" that prompts "Puzzled" to ask for a "rule" for answering such a question as that which he propounds. There are an infinite number of such problems, and each would require a different rule. Moreover, to put the rule into words, would require about a quarter of a page probably, and even then would very likely be difficult to understand. It is, therefore, much better that arithmetical works should confine themselves, as they generally do, to the simple principles of rudimentary calculation, leaving problems to be solved by elementary algebra, which is easily learnt, and which does the work by appealing to the reasoning faculties without burdening the memory with countless rules.

What is called a "simple equation" in algebra readily shows the way how to answer "Puzzled's" question. This is the arithmetical working of it; but how to put it in words as a "rule" would require rather a complicated piece of English composition:

From $\frac{3}{7}$ deduct $\frac{3}{11}$ and the product of $\frac{8}{11}$ and $\frac{1}{14}$. The remain-

der is $\frac{8}{77}$. Turn this fraction upside down, thus, $\frac{77}{8}$, and multiply by $\frac{4}{7}$ths of 28. The $\frac{4}{7}$ths of 28 is 16; and $\frac{77}{8}$ multiplied by 16 is 154. 154 feet is the length of the longer portion of the rod. Add 28 feet, and 182 feet, the length of the entire rod, is the answer required. M. A. I.

407, 409.—Arithmetical Problems.—The first query is not one that can be answered *definitely*. It is *not* possible to find, from the given data, how many of each coin there *were* on any particular occasion, but only how many there *might* have been, because the problem, as it stands, admits not of merely *one* solution, but of an *enormously large* number of solutions. Taking the numbers of all but three of the coins to be any numbers within certain limits that we please, it is generally possible to fit in the rest (often in several ways) so as to make up the required amount with the given number of coins. The following number of coins, for example, will satisfy all the conditions of the problem:—

10, 100, 10, 10, 10, 10, 10, 10, 73, 1361.
31, 4, 2, 1, 1, 1, 1, 1, 3, 1559.

But we can, for example, replace 2 sixpences and 3 pence by 5 threepenny bits, or *vice versa*, any number of times without altering the number of coins or their amount. Similarly, we can replace 2s. 6d. and 6d. by a two-shilling piece and a shilling. This leaves us no wiser than we were at the outset as to what actually was the number of each coin.

The second question is one of the large class of arithmetical questions known *par excellence* as "problems." No fixed rule can be given for solving these, but the method of solution must depend on the question. To proceed:—Call the longer and shorter pieces A and B (for the sake of distinction, and not to introduce algebra). When 3/11 of the piece B is added to A, 8/11 is left. Of this remainder we are to further add 1/14 to A; this leaves 13/14—*i.e.*, 13/14 × 8/11, or 52/77 of the *original* length of B not added to A. Since the piece A, with the two added lengths, is 3/7 of the whole, therefore the remaining piece which we have seen is 52/77 of the original length of B forms the remaining 4/7 of the whole. Therefore, the original length of B is 77/52 × 4/7 of the whole—*i.e.*, 11/13 of the whole. The shorter length A will make up the remaining 2/13 of the whole length. The whole length is, therefore, 13/2 of the length of A, and since A is 28 feet long the whole length is 28 × 13/2 feet, or 182 feet. G. H. Bryan.

409.—Another Rule Wanted.—I do not know of any special rule for these problems in arithmetic. They are best worked by

algebra. It can, however, be solved as follows:—The part added on to the shorter piece of wood is $\frac{3}{11}$ of the longer piece, and $\frac{1}{14}$ of the remainder—*i.e.*, $\frac{1}{14}$ of $\frac{8}{11} = \frac{4}{77}$. This makes the whole amount added on to be $\frac{3}{11} + \frac{4}{77} = \frac{25}{77}$ of the longer piece. By the question, this $\frac{25}{77}$ of the long piece is equal to $\frac{3}{7}$ of the long piece and $\frac{3}{7}$ of 28 ft. or 12 ft.

Therefore, 16 ft. and $\frac{25}{77}$ of the long piece is equal to $\frac{3}{7}$ of the long piece, from which it follows that $\frac{3}{7}$ of the long piece, less $\frac{25}{77}$ of the long piece (that is, $\frac{8}{77}$ of the long piece) is equal to 16 ft. The long piece is, therefore, 154 ft. long, and the whole length is $154 + 28 = 182$ ft. J. G. P. Vereker.

409.—Another Rule Wanted.

Remainder $= \frac{8}{11}$ long and $\frac{1}{14}$ of this $= \frac{8}{154}$ of the long part.

(1) $\frac{3}{7}$ of whole $= 28$ feet $+ \frac{3}{11}$ long $+ \frac{1}{14}$ remainder.

(2) $\frac{3}{7}$ of whole $= 28$ feet and $\frac{3}{11}$ long $+ \frac{8}{154}$ of the long part.

(3) $\frac{3}{7}$ of whole $= 28$ feet and $\frac{50}{154}$ long $\left(\frac{3}{11} + \frac{8}{154} = \frac{42 + 8}{154} = \frac{50}{154}\right)$.

Multiply by 154; then 66 times whole $= 4312 + 50$ long.
But whole $= 28$ feet $+$ long.

$\therefore$ 50 whole $= 1400 + 50$ long.

$\therefore$ 16 whole $= 2912$.

Whole $= \frac{2912}{16} = 182$.

Or from third line above:—

Whole $= \frac{28 \times 7}{3}$ and $\frac{50 \times 7}{154 \times 3}$ long.

„ $= 65\frac{1}{3}$ and $\frac{50}{66}$ long.

Also the whole $= 28 +$ long.

$\therefore$ $\frac{16}{66}$ long $= 37\frac{1}{3}$.

$\therefore$ Long $= 37\frac{1}{3} \times \frac{66}{16} = 154$.

Total length, $154 + 28 = 182$. J. W. G.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place, when more than one question or answer is sent by the same correspondent. Each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply. All answers should be sent to the Editor, 1 Cambridge Place, Bath, and must reach him before the 12th of the month.

415.—Drawing Micro Objects.—Will anyone give the simplest and easiest way for an amateur to draw micro objects, and which is the *best* and also cheapest instrument for the purpose?

416.—Transferring Pictures.—How may pictures be transferred to wood—by means of methylated spirit or by some other method?

417.—Zinc Cement.—I have some of this, which, however, does not harden properly or become white, as it should do. Will anyone give me a hint on the subject?

418.—Teeth of Flies.—Some few months ago, in reading the papers in *Science Gossip*, on "The Teeth of Flies," I could find no methods of preparation, as I should much like to examine slides of these. Will any reader kindly help? ENQUIRER.

419.—Mounting in Balsam.—Why is it that after leaving objects in clips for a week or more, the balsam will not set, and upon cleaning away the superfluous balsam, the air gets under the cover-glass, works its way towards the centre, and spoils the objects?

420.—Dendritic Spots.—What is the method to mount dendritic spots on paper to show under the microscope?

421.—Coccoliths.—How may Coccoliths from chalk be mounted for preservation?

422.—Chalk-Organisms.—What is a good and simple way to mount chalk-organisms?

423.—Lettuce-Leaf.—How can I prepare the leaf of the lettuce to show the calciferous vessels, as figured in Thome's "Botany"?

424.—Book on Minerals.—Could anyone give the name, price, etc., of a good book on minerals, giving formulæ, reactions, and other data? F. W. STEEL.

426.—Decolorising and Staining Leaves.—Can you tell me the *best* plan of *decolorising* and staining leaves, so as to show their structure? F. L. S.

427.—Aquarium.—Shall be very glad to have any practical hints as to starting a fresh-water aquarium, or advice as to best books on the matter. T. J.

428.—Mounting Crystals.—Have taken great interest in the subject of Crystallography, and have very successfully mounted several specimens. The difficulty I am in, however, is, that some salts do not mount well in balsam. I have temporally mounted some in castor oil, and am delighted with their beautiful appearance, yet feel certain that sooner or later the covers will come off. Can some reader, who has had experience in the matter, throw out a few hints for the successful mounting of these very beautiful objects? Also stating the name and price of some work treating on Micro-crystallography generally. O. B.

429.—Stinging Hairs.—Will some kind reader, who has successfully mounted the stinging hairs of the common nettle, kindly give the *modus operandi*, naming the medium used, whether weak spirit of wine, glycerine, or glycerine jelly. O. B.

A CALCULATING-MACHINE.—One of the most ingenious of recent American inventions is a calculating-machine called "The Comptometer." It is the work of a resident of Chicago, and with its aid the most complicated mathematical computations can be made with great ease, accuracy, and swiftness. The instrument is $14\frac{1}{4}$ in. long, $7\frac{1}{4}$ in. wide, 5 in. high, and weighs 8 lb. It can be placed upon an ordinary table. It differs from all other machines of this character, as it can be worked with a type-writer key-board. This machine performs large multiplications in a second of time. It was recently tried by the official experts at the Treasury at Washington. Various examples not previously known to the inventor were given to him for the testing of his apparatus as well as to experts detailed from the Treasury. The machine always surpassed the experts in speed, and was invariably correct. The inventor was given an example like the following:—"Suppose you bring £234 from England to New York, where the rate of exchange is \$4.84⅞, what is the American value of your money?" In one second of time, this marvellous calculating machine recorded the correct answer of \$1,134,60¾.

Sale and Exchange.

MICRO-POLARISCOPE.—Large quantity of fine slides of brilliant crystals for sale; list.—Adlington, Broughton Fields, Worcester.

Reviews.

THE INTERNATIONAL ANNUAL of Anthony's Photographic Bulletin. Editors: W. Jerome Harrison, F.G.S. (Birmingham, England), A. H. Elliott, Ph.D., F.C.S., New York, U.S.A. Post 8vo, pp. xix., 643. (London: H. Greenwood & Co., 2 York Street, Covent Garden. New York: E. & H. T. Anthony and Co., 591 Broadway. 1888.)

This is the first issue of a new Photographic Annual published in connection with the Photographic Bulletin. It is a fine work and contains information on a great number of subjects, which will doubtless prove most valuable to the photographer.

RESEARCH.—We have been favoured with copies of Nos. 2 and 3 of this interesting Journal of Science; they contain amongst other valuable articles, papers on the Museums of Chester and Bath, well-engraved portraits and short biographical notices of Sir Henry E. Roscoe and the Rev. W. H. Dallinger; the Bugle Coralline; Theories of Mountain Formation, etc., etc.

SCIENTIFIC NEWS FOR GENERAL READERS.—The No. for September 7th, besides a number of valuable and interesting articles, well illustrated, on several subjects, contains the Address of the President of the British Association, with voluminous abstracts of addresses in the Mathematical and Physical, Chemical, Geological, Biological, Geographical, and Mechanical sections. It gives also the continuation of a paper on the Geology of Bath, etc., etc.

LIFE LORE.—Nos. 2 and 3 (August and September) of this new magazine of Natural History are to hand; they contain a number of nicely illustrated articles on various subjects, *e.g.*, Rockboring Mollusca, the Study of Dragon Flies, Nature's Famous Disciples, Recent and Fossil Arachnidæ, etc., etc.

HEARTSETTE.—This is a new game of cards recently published by Herbert Fitch and Co., Bury Street, London. It may be played by three, four, or five persons, each player being for himself and against all others.

ANOTHER WORLD; or, the Fourth Dimension. By A. T. Schofield, M.D. Crown 8vo, pp. 92. (London: Swan Sonnenschein and Co. 1888.)

This is one of the "Scientific Romances," and leads us on through the land of no dimensions up to that of four. The course of reasoning is similar to that pursued in a somewhat widely read book, entitled "Flatland," and from which several quotations are made. The present work is written in an allegorical fashion, and the author draws certain conclusions with regard to religious matters from the analogies previously made, specially showing their bearing on the materialist's philosophy.

The Scientific Enquirer.

NOVEMBER, 1888.

Notes on Vancouver and its Neighbourhood.

By Mrs. Alice Bodington.

THE Indians of this part of the North Pacific coast are remarkable for their utter dissimilarity to the Red Indian of song and story. The last-named noble savage may still be seen at prairie stations, ragged and unspeakably dirty, with possibly a gay, striped English blanket over his rags. Contact with civilisation produces in him only utter degeneration; he is prevented by the benevolent paternal government of the North-West Territory from drinking himself to death, so he dawdles away his whole time in laziness. But he is undoubtedly picturesque; his wild, unkempt, black hair, high features, striped blanket, and rags make him a fine artistic study—at a safe distance. For he is *very* dirty, and his hospitality to the lower forms of life is unbounded.

The Indians of Vancouver and the neighbourhood form a striking contrast, in most respects, to the above description. They are short and *squat* in figure; their legs often bowed, through much sitting in boats; their features appear strongly Mongolian in type. The aquiline nose, thin face, and high cheek-bones, so familiar in the loved stories of adventure of our childhood, have disappeared, and one sees a race with flat, broad faces and great shapeless thick lips. I have never yet seen one of these Indians in rags; they are warmly and comfortably clad in clothes of European cut, which many of our poor might envy them. The secret is not far to seek, for unlike the noble Red Man, the Indian of the coast rivals a Chinese in industry. Not only does he supply the market with game and fish, and work at the salmon canneries, but he turns his hand to any sort of honest labour

within the limit of his capacities. And this capacity for taking up new industries is all the more to his credit when we consider how lately British Columbia has been settled, and how very recently the Indian of the coast has come in contact with the white man. Alas! notwithstanding all possible care on the part of both the central and local governments of Canada; though a large police force is kept up to prevent any sale of intoxicating liquors to the Indians; though lands on the best sites for their fish-drying and potato grounds are scrupulously reserved for them; though the Roman Catholic priesthood work amongst them with their usual devotion and success, yet their death-knell has sounded, and they are rapidly disappearing like their untameable brethren of the North West.

Some weeks ago a great festival of the Catholic Church was celebrated at a pretty white village across Burrard Inlet, which goes by the name of the Indian Mission. Hither Indians flocked for many miles round, coming down the Frazer River in their canoes, and many hundreds at length crowded the white tents they had set up near the little village. Here they feasted and played on their uncouth instruments, and here too they crowded at all hours into their little church, and assisted at those picturesque ceremonies with which their church has attracted the poor and lowly in all ages. The close of this week of festival was marked by a grand procession of seventy canoes, each bearing its little altar, gaily decorated with flowers and bright with lanterns, so that across the Inlet a semi-circle of fire appeared to be slowly advancing. They sang, too, what were intended to be Catholic hymns, but which, coming from throats unaccustomed to Western music, had an extraordinary weird and strange effect. The next day white tents and canoes were no longer to be seen, and the Indians had gone back to their peaceful labours.

Before leaving England I parted with a work, Bentham's British Flora, which I now know would have been invaluable here. I expected, after traversing these thousands of miles of land and sea, with three mountain ranges even between me and Eastern Canada, that I should find a totally new flora. I expected that species from Eastern Asia would be found here, but then I know nothing about what does grow in Eastern Asia except camelias and tea. What was my astonishment to find our own familiar flowers at every turn! Wherever the surroundings permit, that mixture of many plants which makes our English turf is found, utterly undistinguishable to my eye from the grass of any of our green lanes, even to the small white clover. But those lovely ornaments of our grass, beloved of poets and hated of gardeners, are missing: there are no buttercups and no daisies. Wild chrysanthemums (ox-eyed daisy) and wild camomile abound, and

two species of marsh-loving yellow ranunculus, which make us miss the buttercup and daisy all the more. Elder flowers grow thickly in the spring; the beautiful Great Epilobe which fringes the streams of the Midlands abounds; the Musk-plant thrives in every shady, marshy spot; foxgloves, pink clover, bracken, groundsel, all these and a hundred more familiar friends may be found.

But when we come to the wild fruits, though we are equally reminded of England, we feel our country possesses only the survivals of a much richer flora. Wild apple, cherry, and plum, make the woods gay with their white blossoms, whilst raspberries appear with a number of species utterly unknown to us. The finest of these, locally called the salmon berry, would be well worth introducing as an ornamental shrub; its blossoms are larger than those of the cultivated strawberry, pink and rosy lilac; the fruit of the lovely shade of warm yellow known as salmon colour, and pleasant to eat. The blackberries, which look precisely like those on an English hedge, startle one by their flavour, which is much like that of a grape grown out of doors in our climate, and not remotely like a blackberry. It is impossible to avoid the conclusion that we have here a climate and soil admirably adapted for the cultivation of all fruits of temperate climates. Little in the way of fruit-growing has been done as yet, but the little that has been done has had remarkable success, and it is to be hoped that in future years we shall not so assiduously obtain everything from California as we do now. People do not know what a raspberry *can* be if they have not tasted the fruit here; for my part, I do not like to spoil the flavour with cream.

Photographs of the forest scenery of British Columbia do it scant justice. The great height, and possibly the dark colours of the pines, make them appear to be the only trees. Whereas in walking through the forest you hardly catch sight of the tall tops of the pines, and the eye is delighted with a profusion of deciduous trees and shrubs, among which the most beautiful is the maple. Every fallen trunk is covered thickly with tiny pines, ferns, and exquisite mosses, and the standing trees are often covered to a great height with the latter, the grey-bearded, weird, long-hanging, Spanish moss being the most conspicuous of all. Here and there the uncanny Devil's club appears, a very Arab among plants in its uncompromising hostility to man and beast. Its long, thin, grey stems are beset with poisonous thorns, and so is the whole surface of its broad green leaves, which it spreads abroad, unabashed, as if to say "Here I stand, and what plant dares grow under my poisonous shade, and what creature dares touch me?"

Though the plants, as I have before said, bear a strange resem-

blance in the main to those of England, yet I have met with many forms utterly unfamiliar to me. One in particular is a shrub known locally as Dogwood; it bears a conspicuous white flower measuring about four inches across. On examining it more closely, the inflorescence bears a superficial resemblance to that of the *Compositæ*, and may be one of their collateral relations. The apparent white petals are white bracts, from four to five in number, and the florets are set thickly upon a flat receptacle, having all their stamens free. A small plant much resembling at a distance our wood anemone, has exactly the same characteristics on examination—namely, four white bracts and florets, each with its pistil and free stamens.

I feel that of all the interesting things which could be said about my present home, I have said very little. But it is impossible to obtain any information either from books or by word of mouth, so far as my experience has gone at present, and I have been able only to note down what I have seen. I have, however, omitted to mention the curious shell-mounds found on every part of the coast. They are made up almost entirely of clam-shells which formerly constituted one of the principal articles of diet of the Indians. Where the new roads have cut near the shore, they have been excavated for many feet through these shell-mounds, and I myself saw a pine tree overthrown which had been growing on the top of one; a tree which a gentleman (an expert in forestry) said must at least be two hundred years old. The shells are very white and brittle, looking much like the fossil shells in the Red Crag of Suffolk. In the United States these mounds are found under circumstances pointing to a very remote origin; sometimes in places fifteen miles from the present sea coast, and at varying depths under more recent deposits.

Vancouver.

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*Animals with more than Two Eyes.**

By Henry Walker, F.G.S.

YES! animals with more than two eyes.

But are there really such creatures, you will ask? Do we mean real animals and real eyes, or allegorical animals and allegorical eyes? We have certainly heard of such creatures in ancient mythology. Argus is said to have had as many as a hundred eyes.

* From the "Youth's Companion."

These eyes were afterwards said to have been transferred to the tail feathers of Juno's favourite bird, the peacock, and people sometimes pretend to see the traces of them in the peacock tails of to-day.

We do mean real animals and real eyes. And the extra eyes in the living creatures are no mere casual occurrences; they are not "freaks of nature," such as the accidental malformations we sometimes see preserved in museums, or shown in popular exhibitions.

The myriad-eyed animals are neither myths nor monsters. They are examples of the beautiful and symmetrical in nature, and not of the uncommon and repulsive. They live in our world of to-day, fellow-tenants of the beautiful earth, peopling the air, the dry land, and the seas. They are marvellous, yet multifarious members of the zoölogical cosmos, the fearfully and wonderfully made animal world.

There are many-eyed animals both of the sea and of the land. They vary greatly in size, from the little fairy fly, the fiftieth part of an inch in length, to reptiles measuring nearly eighty feet.

Strange to say, not all these curious animals have their eyes on their heads. Indeed, many of them have no heads, and yet they have hundreds of eyes. Others have eyes on their backs as well as upon their heads. Some kinds of shell-fish have thousands of eyes, and these are situated, not on the animal's body, but on its hard, stony shell!

Again, many of these multitudinous eyes are very curiously shaped. It will surprise you to learn through what wonderful windows with variously shaped panes and minute partitions these many-eyed animals look out upon the wide world around them.

Let us begin with the humbler forms of life. We will take the scalloped family as an example. We all know the scallop shell. It has become historical, used as it was as a drinking cup by the pilgrims to the Holy Land in the time of the Crusaders. We see the scallop in the fishmongers' shops, but how many of us know anything about the curious animal within! The creature is absolutely without a head, and yet it is possessed of nearly one hundred eyes.

Lift up the double-edged fleshy "mantle" or envelope which forms the outer covering, and you will find the inner one drooping like a curtain finely fringed. At its base you will see a row of conspicuous black dots, surrounded by tentacles. These are the animal's eyes, which you may count by scores. These eyes have been very carefully examined by zoölogists. They are somewhat rudimentary in structure, when compared with the eyes of man; but they possess a "cornea" or transparent membrane in front of

the eye like our own ; a lens for forming the picture of outside objects, an optic nerve, and other accessories for the purposes of vision.

Very remarkable in so humble a creature is the protection of the lower sides of the eye-ball with a dark coloured pigment, which prevents the access of too much side light. The microscope tells us much more about these eyes of the scallop.

Another animal endowed with more than two eyes is found amongst the various creatures known as Onchidia. These animals, which are sea-slugs, live exclusively on the sea-shore or in brackish marshes. They are found in the Philippine Islands, and in certain parts of the southern coast of Australia. For our knowledge of their structure and the strange position in which their extra eyes are placed, we are chiefly indebted to Herr Carl Semper, professor in the University of Würzburg.

Onchidium, like other slugs, has two eyes on its head, in the usual place ; but it also possesses a large number of eyes on its tough, leathery back ! These dorsal eyes, as they are called, have been found in more than twenty species of Onchidia. Professor Semper has counted as many as ninety-eight on the back of a single Onchidium.

These eyes on the back of the animal occur in groups in some species, and singly in other species. The younger specimens have the greatest number. When the skin of the animal is rough, and raised into little hills, the eye or eyes will be found at the summit. In these cases the eye is retractible ; that is, it can be drawn in so as to avoid the dangers to which its elevated position exposes it.

The Onchidium, then, is better off than the scallop, inasmuch as it has a head, and a multiplicity of eyes in addition. But why should it have eyes on its back ? Such eyes are chiefly directed upwards to the sky, and are quite useless for looking down on the earth, where the food of the animal lies. But it is fairly certain that these dorsal eyes are no purposeless "freak of nature." There is very good reason to believe that they serve to warn the animal of the attacks of a fish which seeks to prey upon it above, leaping upon it through the air.

But some shell-fish greatly excel the Onchidia in the number of their eyes. The so-called coat-of-mail shells, or Chitonidæ, are perhaps the most marvellous myriad-eyed animals we know of. Some of them have as many as eleven thousand eyes. We may well smile at the comparative poverty of the mythological Argus in the matter of eyes when we look at one of these coat-of-mail shells. But the strangest thing about these thousand-eyed animals is yet to be told. Their eyes are not found on the body, as in the case of the scallop ; you will look in vain for them upon

its head or mantle, or broad, creeping disc. Then, if not upon the body, where can the eyes possibly be? The question has only been answered within the last three years, for up to that time all the Chitonidæ were described in the text-books as eyeless. It was Doctor Moseley, professor of anatomy in the University of Oxford, who made the discovery. Whilst washing the shell of one of these creatures with spirit, he noticed that it sparkled here and there as if set with small crystals.

Further and prolonged investigation let him into a secret which has astonished the whole world of zoölogists. The surfaces of many of these coat-of-mail shells are really full of eyes. They glisten at us like diamonds in their calcareous setting, as we view them with a hand-lens of moderate power.

On taking up an oyster-shell, or, indeed, any shell you may have as an ornament in your house, and examining it, you would hardly expect it to have any power of feeling, any more than a stone, so utterly inorganic and devoid of anything like nervous structure does it seem to be. Yet in the coat-of-mail shells, this stony-looking armour, which covers the back of the animal, is so thickly set with eyes and touch-organs that in many cases you can barely place a pin's head upon it without touching some of these organs of sense.

I have before me as I write a Corephium shell, which has, at least, eleven thousand five hundred eyes on its surface. These eyes have their nerves running down through the shell into the body below, and the outer sensations are thus transferred along the telegraph nerves to the brain.

In the centre of the eye we see the outline of the iris. A perfectly transparent and strongly double convex lens is found behind the iris-aperture. So there is no room left for guess-work about these glistening objects which we found in such enormous numbers on the coat-of-mail shells. Their structure and function has been fully made out.

Before we take leave of these wonders of the shore, and come to the scarcely less wonderfully gifted animals of the land, let us mention, in passing, one or two other marine examples of the many-eyed. Have you ever looked with a magnifying glass at the eyes of the lobster? If not, I would advise you to do so. The lobster's two eyes are made up of many smaller eyes, more, indeed, than you would care to count. Moreover, each of these many eyes has its own cornea, lens, optic nerve, and other accessories which go to make up a separate, yet complete, organ. Every one of these separate eyes is set diamond fashion, and on the face of each diamond is a cross.

This singular and beautiful pattern is repeated in hundreds of these component eyes, so that the lobster looks out upon the world from a very curiously decorated window indeed.

Our green fields and woods, in summer, are gay with creatures endowed with more than two eyes. Soaring on gauzy or painted wing, in the sunshine, or making the light air luminous in company with leathern-winged bats as large as themselves, they look upon the world through, not merely hundreds, but thousands of eyes,—wonderfully latticed windows and panes of many patterns. The world of moths and butterflies, of bees, ants, and beetles, of winged visitants to our gardens and study windows, is an inexhaustible treasury of animals, too commonly thought to exist only in fable. At home, indoors in the winter months, the cricket on the hearth, that merry little minstrel, looks upon us with hundreds of curiously shaped eyes.

Among the smaller creatures, the ants of our gardens, conservatories, woods, and fields, afford interesting examples of the many-eyed. Some kinds of ants have no eyes at all, but only eye-sockets. The males have generally the largest number of eyes; as many as twelve hundred have been found in a single individual. In the less bountifully endowed species, the eyes are found to vary from one to five in number. Each eye is hexagonal, or six-sided, in shape.

These six-sided eyes are the form most commonly found in insect-life. Bees, butterflies, beetles, and ants, afford good examples of them. The compound eye of the living bee, when examined under a lens, shows them in startling numbers. As many as twelve thousand six hundred six-sided eyes have been found on the head of a single worker bee.

But another fact remains to be told. Mr. Frank Cheshire, one of the most successful "workers" of the London Royal Microscopical Society, has carefully measured the diameter of one of these twelve thousand six hundred eyes; he finds it to be a little more than the thousandth part of an inch. Do not forget that each of these six-sided panes is really a separate eye, with its own lens, crystalline cone, and microscopic telescope behind, running back to the retina, where the picture is formed. There is reason to believe that one use of this vast multiplication of eyes is to enable the insect to see with tolerable clearness in what would be to us darkness. Nearly all the operations carried on in the hives are done during the day-time, in very dim light; and in the night time, when work is by no means intermitted, there would be to our eyes absolute darkness. To the bees, however, the scanty rays, received by so many sensitive points of sight, may be sufficient to enable them to see with comparative clearness.

As we have said, the hexagon is the form most commonly found in insect eyes. But there are some very curious exceptions to the rule. The thousand-eyed drone-fly and the house-cricket

are instances in point. We shall find the drone-fly, known as *Eristalis tenax*, hovering over or alighted on a head of flowers in full bloom. He is sucking the juices from the petals or eating the pollen from the anthers. He is a stout, pitchy-black, hairy fly, more than half an inch in length. Notice the tawny spots on the abdomen, and the triangular spots of the same colour on the side, and you will remember him.

The two compound eyes, projecting on each side of the head, are easily seen; half globular in shape, they are relatively immensely larger than the eyes of the higher animals. I take a dead specimen, and tenderly remove the front membrane of one of these compound eyes. I carefully remove the dark colouring matter at the back, using a soft camel's hair brush for the purpose; and, after washing the membrane in spirit, I put it on a thin slip of glass, and then look at it, or, rather, through it, with a hand-lens.

What do I see? The cornea proves to be a beautifully transparent lattice, fitted with thousands of six-sided window-panes. Is any cathedral window, however vast, half so wonderful? I can count the number of these separate window panes, each of which, again, is a complete eye. There are more than four thousand of them. But, as I trace them downward, I notice a curious change in their shape.

They gradually pass from hexagons into squares—from six-sided panes into four-sided panes. The upper half of the window, as I have called the compound eye, is filled with panes of one pattern, and the lower half with panes of another pattern. This is a very remarkable occurrence. As far as I know,—and I have examined some scores of insects' eyes of different species,—it is confined to the drone-fly.

The "portcullis eye" of the house-cricket is an example of the square-shaped eye-facet, in which the lens is framed; but in this case, all are squares, and none of them hexagons. If you examine the cricket's eye, you will find hundreds of the eye-facets arranged in rows. Each facet is barred off from its neighbour by a thick, horny partition, giving the whole the appearance of the heavily-timbered framework, which used to be let down before the entrance of old castle gateways. Hence the name "portcullis" eye.

We have next to deal with much larger kinds of animals than those hitherto mentioned. The discovery that lizards have a third eye, now in most cases buried beneath the skin, but formerly situated at the top of the head, is one of the very newest and most startling achievements of zoölogical investigation. In some of the smooth-skinned lizards, this third eye, though no longer in use, is still visible on the top of the scaly head, being placed just

under a large transparent scale, which serves to protect it. All the lizards are found to possess this third eye at the crown of the head, the other two eyes being in the usual position. The giant lizards of geological antiquity were also three-eyed. Some of them, like the Mosasaurus, were as much as seventy-five feet in length.

The zoölogists tell us strange stories about the wonderful forms of life which existed in the times of the Mosasaurus. Yet it is well to know that we are living amongst the descendants of these three-eyed giants, and that in almost any museum the skull of the commonest lizard of to-day shows the socket for the accommodation of this extra eye.

The world of to-day is quite as wonderful as that of the past. Like the marvellous in nature of every kind, the creatures we are so ready to disbelieve in—except we read of them in books of remote travel and adventure—are all around us. Every winged creature that flies in the firmament, except birds and bats, and untold millions more that creep on the green earth, are equipped with two beautiful geometrical windows, in which are hundreds or thousands of complete and perfect eyes.

In the ocean, too, as we have seen, Argus-eyed creatures abound. Strange, yet true, is the conclusion at which the zoölogist has arrived. Animals with more than two eyes, so far from being rare and exceptional productions of nature, are actually in the majority. They vastly exceed in numbers those which are endowed with no more than two. The story of Argus is indeed outdone by the story we may read for ourselves in Nature's ever-open page.

Short Papers and Notes.

Chalcedony Park.

MR. W. Adams, jun., was the discoverer of the celebrated petrified forest of Arizona, now generally known as Chalcedony Park. This deposit is situate about twenty-five miles south east of Holbrook, in Apache County, Arizona. The silicified trees are found protruding from the volcanic ash and lava, which is covered with sand stone to the depth of 20 or 30 feet. Sections

of this fallen forest, whose only rivals are the giants of the Yosemite and Calaveras, lie around in profusion, measuring from 2 to 10 ft. in diameter, containing all the colours of the rainbow, some of whose hearts are solid crystals of amethyst and topaz, and only a slight degree from the diamond in hardness. Every colour found in nature or the arts is reproduced in these fallen agatised monarchs.

The Wasp, the Daddy-Longlegs, and the Robin.

A correspondent at Hastings sends us the following anecdote: —Students of Nature see curious things, but we venture to think that such an experience as the following has been the lot of but few:—On one of the hot mornings with which we have been lately favoured four gentlemen sitting in the Alexandra Park at Hastings were surprised at seeing an insect, familiar to us in our childhood by the name of Daddy-longlegs, fall in front of them with a wasp on his back. The wasp hugged tenaciously, apparently inserting his sting deeply into the head of his prey. In the course of a minute or so the wasp flew away, and its victim with legs partly broken was slowly crawling to a neighbouring thicket, when, to the amusement of the onlookers, a large and impudent robin alighted on the ground about two yards from the injured insect. Eyeing the quartette somewhat impudently he gave two or three little hops in the direction of the coveted insect. Here he paused, made his bow, took a long hop, then two or three smaller ones, surveyed the spectators, seized the Daddy-longlegs in his beak, and was gone ere they had fully comprehended what he was about. After a good laugh it was remarked upon as being a fine illustration of the manner in which the dumb creation feed upon one another; and one philosopher also remarked that it was a very good example of the manner in which we ourselves are sometimes treated, for no sooner have we got rid of one difficulty than we oftentimes meet with a worse.

Diagnosing Human Blood.

Dr. H. D. Formad, in *Journal of Comparative Medicine and Surgery*, says:— "It can be regarded as established that the microscopist has ample and sure means to diagnose fresh or well preserved human blood from that of certain animals, provided he has the proper experience and employs rightful and honest means." He relies largely upon the microscope for this differentiation, using a 1—18 Zeiss homogeneous immersion lens, which magnifies about 2250 diameters. Micro-photographs made from this amplification,

magnified to the uniform scale of 10,000 diameters, show recognisable differences in size between the blood-corpuscles of man and those of the domestic animals, dog, ox, sheep, and goat, whose corpuscles nearest approach in size those of man.

A Village Destroyed by Ice.

Advices from the fishing village of Kerschkaranza, in Kola, a peninsula on the White Sea, describe a wonderful phenomenon, new in Arctic annals, which took place on the 5th January, 1888. At 4 o'clock in the morning the inhabitants were awakened by a series of heavy, dull detonations, like heavy artillery. Shortly afterwards a great ice wall, to the north-west, several hundred feet high, was seen to be moving towards the village, doubtless in consequence of the pressure of the ocean ice outside. The ice-hills came slowly but irresistibly onward, and passed over the village, which they completely erased, and kept onward for a mile inland. The ice travelled a mile and a half in four hours. The villagers saved their lives, but little else.

Remarkable Sheep.

A Russian correspondent of the *Pall Mall Gazette* has sent an account of an extraordinary race of sheep, This is the *Ovis Poli* of Marco Polo, which has its habitat in the extreme south-east corner of Russian Turkestan. The "*Ovis Poli*," we read, is a kind of philosopher's stone, for which all the sportsmen of the Himalayas keep searching all their lives. It is an animal twelve and a half hands high, with a head and horns which are the envy and despair of all the hunters of Asia. Magnificent, indeed, are the curved and involuted horns, measuring at least five feet between the tips, but each horn, measured from the base along the curves, is six feet long. This huge sheep lives in the most inaccessible corner of the most mountainous region in all Turkestan, just on the north of the Pamir Plateau, the first of the gigantic series of mountains that form the northern bulwark of India. It is only in July and August when the Alai range can be traversed by Europeans, and in these months it is the habit of the male *Ovis Poli* to leave his wives, who brouse on the undulating plateaux which are found 10,000 feet above the sea, and retire to enjoy bachelor solitude among the snow-peaks that tower to the height of 14,000 feet.

Photographic Notes.

Simple Method of Gelatinising Prints.—The glass plate, well cleaned, and rubbed with a little talc in powder, then wiped; the edges are coated all round with gum arabic, which is allowed to dry. The plate is then coated with collodion, and it is useless to impart to it the motion used in operating with wet collodion; the plate is simply placed on end, so that the collodion drains from the lower end. This manipulation is performed the preceding day. On the next day dissolve the gelatine by placing it in a wide-mouthed vessel filled with water; this vessel is heated over a water-bath. As soon as the gelatine is dissolved the solution is poured into a flat plate, and on it are floated a piece of strong white paper, somewhat larger than the glass plate, and at the same time a print. In about half-a-minute the print is to be removed and placed the image-side down, on the collodionised side of the glass plate; a sheet of paper is placed directly over it, press to remove the gelatine in excess. This is received in the dish. The plates are now exposed in the shade for two hours, then in sunlight for two or three hours. When desiccation is completed, the paper and print are detached from the glass plate. Should there be no sunlight, recourse may be had to artificial heat. To mount the print, prepare a solution of gelatine sufficiently thick, using hot water; with this solution, and with the aid of a brush, coat the edges of the back of the print, which is to be quickly placed on cardboard and pressed by means of a fine cloth. The image adheres very strongly.—*Photo. Archiv.*

The Enamel Process of Mr. Reinhardt.*—Dear Sir,—On my return from the country, I found yours of the 8th inst. I have myself been troubled with having the photos stick to the glass while enamelling, but have eventually overcome it. In the first place it is necessary to use collodion made with good alcohol and ether; I use five ounces of each and seventy grains of gun cotton. The plates should be at least half-an-inch wider than the picture, and one inch or more longer, for this reason: To squeegee the picture and paper down on the plate it is necessary to hold the paper in its place by pressing down on it with the fingers, but these should not touch also the picture below the paper. Therefore, by having both the plate and the paper larger than the picture, it leaves a margin sufficient to hold it in place without

* In reply to a letter which appeared in the *Philadelphia Photographer*.

exerting any pressure on the picture; it appears that by pressing down the fingers the collodion film is displaced and allows the gelatine to come in contact with the plate, and of course causes it to stick. Since I have observed this caution, I have never had any trouble. LOUIS REINHARDT.

Sauga La Grand, Cuba.

Photographs of the Sun and Weather Predictions.—One of the Photographic Journals relates that the photographs of the sun, taken daily at Prague by Professor Zenger since 1877, have proved very useful for making meteorological reports and predictions regarding the weather. In these prints are often seen circular or elliptical rings, white or grey, around the disc; sometimes these zones, as they are called, spread over the disc itself, and impart to it a greyish appearance. Observation has shown, since several years, that these zones are more dense and more wide-spread before the electric or magnetic storms at the surface of the earth, and they enable the prediction to be made of a coming storm. It is evident, therefore, that the cause of this appearance on the photographic plate is to be found in the terrestrial atmosphere. According to the author, these zones indicate a storm twenty-four hours in advance.—Dr. Phepson in *Philadelphia Photographer.*

Practical Hints.

To tell Fresh Eggs.—The following, says *The Boston Journal of Commerce*, is a simple French test for telling whether eggs are fresh or not. Dissolve two ounces of kitchen salt in a pint of water. When a fresh egg is put in this solution, it will descend to the bottom of the vessel, while one which has been laid the day previously will not quite reach the bottom. If the egg be three days old, it will float in the liquid, and if more than three days old it will float on the surface, projecting above the water more and more as it happens to be lighter with increased age.

Ink for Rubber Stamps.—Take aniline rose or violet, 90 grains; boil this in 1 ounce of distilled water; then add half-a-teaspoonful of glycerine and half as much molasses. The crystals of the aniline dye must be worked up with the boiling water, and the other ingredients added in succession. This ink does not readily smear, and yet does not easily dry upon the pad.

Microtome.—To make a microscope take the place of a microtome, use the tube to carry the imbedded object and the movable

stage to carry the razor. The object to be cut is moved by the fine adjustment.

Rust-Stains.—To remove rust-stains from nickel-plated instruments, thoroughly grease the instrument, and after several days rub with a cloth moistened with ammonia. If any spots are still visible, they are touched with dilute hydrochloric acid and immediately rubbed off. The instruments are then washed and polished with polishing powder.

Preserving Instruments from Rusting.—Immerse them in a solution of carbonate of potash for a few minutes, and they will not rust for years, not even when exposed to a damp atmosphere.

To Restore the Polish of Instruments.—Place them in a vessel containing a saturated solution of stannous chloride in distilled water, and leave over-night. Rinse in running water, wiping and rubbing with a chamois to finish. Zinc chloride gives only fair results.

Etching Liquid for Steel.—Mix one ounce of sulphate of copper, one-fourth of an ounce of alum, and a half-teaspoonful of salt reduced to powder, with one gill of vinegar and twenty drops of nitric acid. The liquid may be used either for eating deeply into the metal, or for imparting a beautiful frosted appearance to the surface, according to the time it is allowed to act.

Testing Water.—Heisch's test for sewage contamination is as follows:—Fill a clean pint bottle three-fourths full with the water to be tested, and in this dissolve half-a-teaspoonful of the purest sugar; cork the bottle and set it in a warm place for two days. If in twenty-four to forty-eight hours the water becomes cloudy or milky, it is unfit for use. If it remains perfectly clear, it is probably safe to use. Another method is worthy of trial:—Half fill a bottle with water, cork tight, and set it for a few hours in a warm place. Shake up the water, remove the cork, and critically smell the air contained in the bottle. If it has any smell (particularly if its odour is repulsive), the water should not be used for domestic purposes. By heating the water, an odour is involved that would otherwise not appear.

Answers to Queries.

404.—Soda-Lye.—Is a solution of an alkali; water impregnated with alkaline salt, imbedded from the ashes of wood. Used in soap-making, in neutralising an acid, and in cleansing grease from objects, such as thin iron plates in the operation of tinning, etc.

V. A. L.

395.—Infinite and other Series.—The phrase, "sum of an infinite series," means that limit (if any) to which the sum of a finite number of terms approximates constantly and with indefinite closeness as the number of terms is indefinitely increased. An infinite series has no finite sum if no such limit exists. An infinite divergent series may exactly resemble a binomial expansion. But the binomial theorem is only true when the series is convergent (see Todhunter's Algebra, § 519, and the answer by G. H. B., p. 175).

Hence the series, $1-5+15-35+70-126+\ldots$, is not $=(1+1)^{-5}=\frac{1}{32}$. Its sum to n terms can be found, in virtue of the fact that the series 1, 5, 15, 35, 70, 126 ... has its third differences in arithmetical progression. The sum is $+(n+1)(n+3)(n^2+4n+1)\div 48$ when n is odd, and $-n(n+2)^2(n+4)\div 48$ when n is even. Putting n infinite, the sum is $+\infty$

Series whose differences (of any order) have received, I think no general name, their general term can always be expressed as a sum of multiples of figurate numbers. Thus, the general term of the series 7, 8, 8, 8, 9, 12, 18, is $\frac{n(n+1)(n+3)}{6}-4\frac{n(n+1)}{2}+6n+4$. The treatment of all such series reduces, therefore, to that of figurate ones. C. W. C. Barlow.

407.—Rule Wanted.—The only rule for solving such a problem needs algebraical symbols, and even that is highly laborious except in simple cases. By making the arbitrary assumption that there was one shilling and one of every coin of higher value, but thirty £5 pieces, I found eighty solutions. The actual number is reckoned by billions. C. W. C. Barlow.

409.—Another Rule Wanted.—A long rod is divided into two parts, of which the shorter is 28 ft. Add $\frac{3}{11}$ of longer piece to shorter, and then add $\frac{1}{14}$ of remainder. The result will be $\frac{3}{7}$ of the whole.

$\frac{1}{14}$ of remainder is $\frac{1}{14}$ of $\frac{8}{11}$ of longer piece, $=\frac{4}{77}$.

$\frac{3}{11}$, together with $\frac{4}{77}$, is $\frac{25}{77}$.

Thus, if $\frac{25}{77}$ of longer piece is added to shorter, the result is $\frac{3}{7}$ of the whole rod, $=\frac{3}{7}$ of longer, and $\frac{3}{7}$ of shorter.

It follows that $\frac{3}{7}$ of longer $=\frac{25}{77}$ of longer and $\frac{4}{7}$ of shorter.

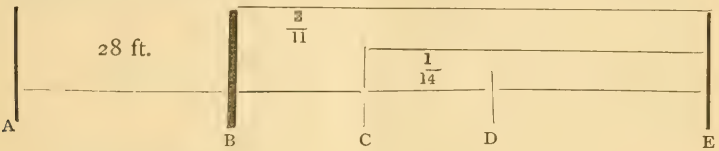
" $\frac{33}{77}$ " $=\frac{25}{77}$ " and 16 feet.

$\therefore$ $\frac{8}{77}$ " $=16$ feet.

And the longer part is $\frac{77}{8}$ of 16 feet, $=154$ feet.

The entire rod was, therefore, 182 feet long. The work would be much shortened by using algebraical notation. C. W. A. B.

409.—Another Rule Wanted.—I do not profess to be a mathematician; at the same time, I cannot help thinking that your correspondents have gone a long way round to answer a very simple question. The following appears to be a common-sense view of the case, although it may be somewhat "wordy"; but I suppose those who answered this problem used an argument perhaps quite as lengthy as mine if they have not shown it. The rod is divided thus:—



A B is 28 feet.

B C is $\frac{3}{11}$ of B E, and is consequently $\frac{3}{8}$ of C E.

C D is $\frac{1}{14}$ of C E, and is consequently $\frac{1}{13}$ of D E.

A D is $\frac{3}{7}$ of entire length; therefore, D E is $\frac{4}{7}$ of entire length, $\frac{4}{7} + (\frac{1}{13}$ of $\frac{4}{7}) = \frac{52+4}{91} = \frac{56}{91}$; $\frac{56}{91} + (\frac{3}{8}$ of $\frac{56}{91}) = \frac{56+21}{91} = \frac{77}{91}$; $1 - \frac{77}{91} = \frac{14}{91}$, showing that $\frac{14}{91}$ are required to make the rod complete, and as we know that $\frac{14}{91}$ is 28 feet, we say, 14 : 28 : : 91 : 182 feet the answer.

PUZZLED.

415.—Drawing Micro Objects.—I use a Beale's neutral-tint reflector for drawing objects, and find it simple and easy to work with after I acquired a little skill by practice. There is no royal road to drawing micro objects for any amateur. Just study the directions given so fully in any of the numerous books on using the microscope, and regulate the light carefully. I make the outline only with the neutral-tint reflector, and fill up the details from direct observation. There is a difficulty to be overcome here, because the object or its image is "doubly reversed," if I may use the expression, by the reflector, and one has to become accustomed to the change before being able to work in the particulars. The "best and cheapest instrument" for any purpose is that one which does its work well and is not too costly. Such are any of the "cameras" manufactured for fitting on to the eyepiece of the microscope. I have read in *Science Gossip*, Vol. XXII., p. 172, that it is possible to make an efficient article with a small pill-box and a cover-glass, which would surely be the "cheapest" instrument; but I never saw one except in the drawing illustrating that article.

H. W. LETT, M.A.

417.—Zinc Cement.—There must be some fault in the composition of the zinc cement which does not harden properly or become white when slides are ringed with it. If such is the case, better discard it and purchase a fresh bottle. Or could it be that the cement has not been sufficiently shaken up before being used? If so, the zinc white would be at the bottom of the bottle, and the varnishing would be done with a mixture of balsam and benzole, or some similar compound. I keep a piece of steel wire, like a stout knitting-needle, about one-eighth of an inch thick, for the sole purpose of stirring up and mixing well the contents of my zinc-white cement bottle before ringing slides; and I may mention that just now I am very near the bottom and end of a bottle, and it works as pleasantly and finishes as satisfactorily as when I first opened it. From time to time it is necessary to add a little fresh benzole, to make up for the loss by evaporation.

H. W. Lett, M.A.

419.—Mounting in Balsam.—The cause of air getting under the cover-glass in balsam mounts when the spring clip is removed, and the superfluous medium is being scraped off, is due to the clip having exerted too great pressure. I once met with the same annoyance, but when I discovered the cause I gave up the ordinary wire clips, and adopted the *Science Gossip* spring-clip board, which I constructed for myself with a piece of pine board, a few small screw-nails, and some crinoline steel, and now I never meet with mishaps. It gives sufficient, equal, and gentle pressure. But besides this, I always, when mounting in balsam, follow Cole's directions, and place the object in some balsam on the cover, where it remains for some hours till the benzole or chloroform has sufficiently evaporated from the balsam, when it is placed in position on the glass slip, which must be previously warmed. For further instruction, see Cole's "Method of Microscopical Research."

H. W. Lett, M.A.

Queries.

All Questions and Answers should be clearly and concisely written on one side of the paper only, and every question or answer must bear the name and address of the writer. If this is written on the left-hand bottom corner, it will not be published, in which case initials or other signature should appear in the usual place. When more than one question or answer is sent by the same correspondent, each must be written on a separate piece of paper.

Correspondents, in sending us answers to questions, are desired to commence by quoting the number and title of the question as printed, before beginning their reply. All answers should be sent to the Editor, 1 Cambridge Place, Bath, and must reach him before the 12th of the month.

430.—Portland Cement.—Can anyone say how this is manufactured? I understand it is somewhat in the following way:—Caustic

lime is mixed with Thames or Tyne mud (how much? And is the mud burnt before being mixed with the lime? And how is the mixing done?), *dried* (into what shape is it put before being dried, and how is the drying done?), *burned* (is it raised to a red or white heat, and in what sort of kilns?) *ground*, (is this done with mill-stones or rollers?). What is the chemical composition of the lime, of the mud, and of the cement? What are the chemical reactions that take place? 1stly, When the lime is mixed with the mud? 2ndly, When the mixture is burned? 3rdly, After the cement is mixed with water and used? S.

431.—Foraminifera.—What is the best method to mount and *prepare* sample of unwashed, also washed bottom foraminifera? C.

432.—Mounting Specimens.—Will any reader kindly give detailed directions how I should *mount* specimens in spirit and others in water of Mackerel food, "Cayenne" Calanus Sp.; Themisto bispinosa, and Themora longicornis; and in glycerine or Canada balsam or opaque? V. L.

433.—Red Snow.—Will any reader give a clear account of Red Snow, *Protococcus nivalis?* Is it a plant? H. L.

434.—Mounting in Alcohol.—What cement can be used with safety to finish objects mounted in alcohol? H. H. D.

435.—Glycerine Mount.—In specimens mounted in glycerine or glycerine jelly, finished with white zinc and a slight coating of asphalt, the glycerine is now oozing through. How can the enquirer best preserve the objects, so as to prevent running in or loss of the specimens? F. M. S.

436.—Metallic Soaps.—Can anyone give the paper or particulars of the metallic soaps used for ringing, as recommended, I believe, by Professor W. H. Seaman, of Washington D.C.? B.Sc.

437.—Flies.—The other day a fly walked over a paper, and I noticed its body was covered with *blood-red* spots of large size, as were some other specimens. What fungus could this have been, or in what journal or paper can I find an account of it? J. S.

438.—Teeth.—What is the best way to stain and prepare sections of teeth to show micro-organisms? A. W.

439.—Leptothrix.—How do we prepare and obtain specimens of Leptothrix buccolis from the teeth or débris? A. W.

440.—Dermodex folliculorum.—Have any readers of this Journal ever been successful themselves in finding specimens of Dermodex folliculorum in the skin, by the method so often given in books?

441.—Fresh-water Sponge.—What is the best way to prepare (clean) and mount specimens? H. M.

442.—Raising Diatoms.—Will any reader give me a good, simple, and reliable method of raising diatoms in the laboratory? V. L.

Unanswered Queries.—The editor will be glad if readers will supply answers to the following queries, which have from time to time remained unanswered :—

324 Rusty Pork and Bacon
335 Double-Pointed Pins
340 Blue Flame produced by Salt
341 Hoar Frost
347 Removing Shells from Brood
348 Combustion
356 Labelling Cabinets
357 Phosphorescence
362 Double Rose
366 Snow plant
369 Fox Earth
376 Neophytes
379 Section of Flower and Leaf Buds
383 Toads
384 Hairs of Urtica
388 Violet stones
390 Names of Fish
391 Mounting Parasites
392 Snow Crystals
401 Poison of Bees, Wasps, etc.
403 Card Specimens
405 Chironomus plumosus
406 Swift's "Stephenson's Binocular Dissecting Micro."
408 Carduus Nutans
410 Absence of Birds
411 Lamp-Chimneys
412 Curling of Paper
413 Opacity
414 Forming Cells

Sale and Exchange.

Micro-Polariscope.—Large quantity of fine slides of brilliant crystals for sale; list.—Adlington, Broughton Fields, Worcester.

Offered, Cone in Cone. Wanted, Hippodium, Plagistoma, Spiriferina, Diceras, Melania, Cyrene, Cryptodon, Aturia, Voluta Phorus, Conus, Pleurotoma (Pleurotomaria recent), Mitra, Crassatella, Chama, Fulgar Pyrula, Physa, Scaphites, Turrilites, Cardita, Typhis, Terebellum, Crania, Magas, Marsupites, Grevillia, Vicarza, Acrodus, Platystoma, Koninkia, Scoliostoma. Any species recent or fossil, good specimens.—J Smith, Monkredding, Kilwinning.

Answers to Correspondents.

A. P.—Your queries are scarcely of sufficient general interest to publish; we have replied through the post.

W.—It is quite impossible for us to name the Aphides, as you give us no particulars as to where found, &c.

The Scientific Enquirer.

DECEMBER, 1888.

Vegetable Cows.

SEVERAL natural orders of the vegetable kingdom include plants that are characterised by the secretion of a fluid closely resembling milk in appearance and consistency, and a familiar example of these is to be seen in our common milkweed (*Asclepias cornuti*), which is well known to everybody. In some plants, this milky fluid is of the most venomous nature; in others, it possesses active medicinal virtues; in others, it yields a product (such as India rubber and gutta percha) of the highest importance to the arts and industries; and, in others still, it proves of value as a human aliment. Since the same general properties characterise the plants of each natural family, it seems an anomaly that, in the same order, we should find the species of one genus producing a lactescent fluid of a highly poisonous nature, and those of another yielding one that is entirely innocuous. Yet such is often the case, and we have a striking example of it in the bread fruit order, the *Artocarpaceæ*, which, on the one hand, includes the celebrated upas tree of Java, which, when pierced, exudes a milky juice containing an acrid virulent poison (antiarin), the smallest quantity of which will kill the largest animal, and, on the other, the famous *Brosimum utili* of South America, which yields a copious supply of rich, wholesome milk, of as good a quality as that from the cow. There are several other instances in the vegetable kingdom of such an association, in the same natural order, of plants that produce noxious lactescent juice with others which yield a wholesome one adapted for man's use, and which may therefore be designated as "vegetable cows." To speak only of the latter class, the most remarkable example is the species of *Brosimum* just mentioned, which was discovered and made known by the

*From the *Scientific American.*

celebrated traveller Humboldt. This tree forms extensive forests on the mountains near the town of Coriaco, and elsewhere along the sea coast of Venezuela—growing to upwards of one hundred feet in height, with a trunk six or eight feet in diameter, and branchless for the first sixty or seventy feet of its height. It is popularly known as the cow tree, Palo de Vaca, or Arbol de Leche. "Its milk, which is obtained by making incisions in the trunk, so closely resembles the milk of the cow, both in appearance and quality, that it is commonly used as an article of food by the inhabitants of the places where the tree is abundant. Unlike many other vegetable milks, it is perfectly wholesome and very nourishing, possessing an agreeable taste, like that of sweet cream, and a pleasant balsamic odour, its only unpleasant quality being a slight amount of stickiness. The chemical analysis of this milk has shown it to possess a composition closely resembling some animal substances, and, like animal milk, it quickly forms a yellow, cheesy scum upon its surface, and, after a few days' exposure to the atmosphere, turns sour and putrifies. It contains upwards of thirty per cent. of a resinous substance called *galactin* by chemists." (*Treas. of Botany.*) Speaking of this tree, Humboldt says:—"They (the natives) profess to recognise, from the colour and thickness of the foliage, the trunks that yield the most juice, as the herdsman distinguishes, from external signs, a good milch cow. Amidst the great number of curious phenomena that I have observed in the course of my travels, I confess there are few that have made so powerful an impression on me as the aspect of the cow tree. A few drops of vegetable juice recall to our minds all the powerfulness and fecundity of nature. On the barren flank of a rock grows a tree with coriaceous and dry leaves. Its large woody roots can scarcely penetrate into the stone. For several months in the year, not a single shower moistens its foliage. Its branches appear dead and dried, but when the trunk is pierced, there flows from it a sweet and nourishing milk. It is at the rising of the sun that this vegetable fountain is most abundant. The negroes and natives are then seen hastening from all quarters, furnished with large bowls to receive the milk, which grows yellow and thickens at the surface. Some empty the bowls under the tree itself, others carry the juice home to their children."

In the Dogbane order, the *Apocynaceæ*, which includes plants that are mostly of a venomous nature and possess an exceedingly acrid and drastic juice, we have a second example of a tree that secretes a wholesome, milk-like fluid. This is the *Tabernæmontana utilis*, the cow tree of Demerara, or hya-hya of the natives. This tree grows in abundance in the forests of British Guiana, and its bark, when tapped, yields a copious supply of thick, sweet

milk, resembling that of the cow in appearance, but rather sticky from the presence of caoutchouc. This milk mixes freely with water, is of a pleasant flavour, and the natives employ it as a refreshing beverage.

Two "cow trees" are found in the order *Sapotaceæ*, which embraces numerous plants valuable for their succulent fruits, such as the marmalade, star apple, etc. One of these is the *Mimusops elata*, called by the natives massarandaba or aprain, and which Professor Orton, in the *Andes and the Amazons*, describes as one of the noblest trees of the forests of Para. It stands from 180 to 200 feet in height, is 20 feet in circumference, and is crowned with a vast dome of foliage. The milk yielded by the bark has the consistency of cream, and is used for tea, coffee, and custards. It hardens by exposure, so as to resemble gutta percha, which, indeed, is the product of a Malaisian tree belonging to the same natural order. The other tree is the *Mimusops balata*, or bully tree, of English, French, and Dutch Guiana. The milk of this species is sometimes employed with tea or coffee, instead of cows' milk, but has the disadvantage of hardening very rapidly upon exposure to the air.

The natural order *Asclepiadaceæ* consists of plants that are almost always milky, and the milk is usually acrid and bitter, and always to be suspected, yet one of the plants of the family, *Gymnema lactiferum*, the cow plant of Ceylon, called by the natives kiriaghuna, yields a milk which the Cingalese make use of as food.

Another example of a "cow tree" belonging to a dangerous natural order, the *Euphorbiaceæ*, which embraces plants having acrid and purgative juices, is the *Euphorbia balsamifera*, or Tabayba dolce, of the Canaries. Notwithstanding the fact that the plants of this genus have juices that possess very active medicinal qualities, and are in some cases so venomous that they are used as arrow poisons, the juice of the species under consideration is innocuous, and, according to Leopold von Buch, is similar to sweet milk, and is eaten as a delicacy after being thickened into a jelly.

Still another "cow tree" is found in the order *Clusiaceæ* or *Guttiferæ*, which embraces plants that secrete an acrid, purgative, yellow gum resin, such as gamboge. This tree is the *Clusia galactodendron*, a native of Venezuela, where it is known as Palo de Vaca. It has a thick bark, covered with rough tubercles, and its internal tissue becomes red when exposed to the air. In extracting the milk, the inhabitants make incisions through the bark till the wood is reached. These cuts are said to be made only before full moon, it being imagined that the milk flows more freely then than at any other time. One tree will yield a quart in

an hour. The milk is freely used by all, especially by children, although it has a somewhat astringent taste.

In the order *Moraceæ*, which includes the mulberry and fig, there are several species of *Ficus* that are known as cow trees, and the milky fluid of which is bland and used as a beverage, although in most of the species of the genus the juice is exceedingly acrid.

Amber.[*]

By F. R. Kaldenberg.

THE only place in which amber has been found in paying quantities is in the Baltic Sea, and the vein extends from western Russia to Denmark, Norway, and Sweden. In former years the production of amber depended principally upon the storms occurring in the winter time, for when the sea was convulsed the amber lying on the bottom was thrown up on the shore ; but human enterprise stimulated by the demand for the article has changed all this, and for the last twenty-five years various engineering appliances have been used for getting out the amber in the quickest and cheapest way.

The most profitable strata have been found in the Courischer Haaf, which is located in the vicinity of Memel, and there are twenty large dredging boats constantly at work, day and night, for eight months in the year. There are large strings of iron pails that are constantly dragging along the bottom of the sea, and bringing up the sand and what amber there may be in it. This is emptied on the deck of the ship, and there it is washed, and the amber picked out from among the sand and stone.

The little village where this industry is carried on is called Schwartzort. It is situated on a narrow strip of land that extends about ten miles beyond the mainland, and is perhaps a mile wide at its widest part. At one time this strip of land was covered with a forest, but the wood was sold off by a Prussian king in the beginning of this century to the Russians. The land has become barren since stripped of its sheltering forest, and now it is nothing but a sandy waste ; and, were it not for the amber industry, this beautiful peninsular would be desolate. About ninety miles further west is another little village, called Palmnicken, and here the amber is obtained in an entirely different manner. The most approved diving apparatus is used, and the divers go out in row-boats, each of which is fitted with an air pump. They go down into the sea, where some of them remain as long as four or five

[*] From the *Scientific American.*

hours. Each diver has a little bag around his neck, and a peculiar hook, with which he pulls up sand, and every piece of amber that he finds is thrown into his bag. An encouragement to the diver is that if he finds a piece of amber he is entitled to a prize of ten, twenty-five, or fifty cents, according to the size.

While the divers are below in the sea, engaged in hunting for the amber, the miners are just as busy on land, for it seems that the same stratum of the green sand runs, perhaps for thirty miles or more, into the land. The opening of the mine is perhaps a thousand feet from the shore, and it is necessary to go down about one hundred and fifty feet, which is some thirty or forty feet below the level of the sea. To keep the mine as dry as possible, there are several pumps working day and night; and to prevent the earth from falling in, the passages are propped up by logs of wood. There are about forty miles of passageway in these mines, and there are about seven hundred men employed for the various departments. As soon as a passageway is opened, a track is laid, and on this track there runs a little truck, which holds perhaps half a ton of sand. The miners simply cut out the sand and fill the truck. It is then brought to the surface, where the whole contents is thrown into a long trough filled with rushing water, which separates the sand from the amber, which is caught by nets of various sizes. The amber is then cleaned by machinery, and assorted according to its quality and purity. The writer believes himself to be the first American who ever went down into the amber-mine.

Short Papers and Notes.

Notes on Fresh-water Sponges.

By V. A. Latham, F.R.M.S.

Since the time of Linnæus much has been learnt about these organisms, better and more complete knowledge coming with the improvements in microscopy. Such men as Bowerbank, Grant, Carter, and Mills have given the subject much thought and work. Europe, Asia, Africa, and the two Americas have contributed to the number of species. Quite a number of remarkable sponges have been found in the Amazon River, while Fairmount Dam on Schuylkill River, in Philadelphia, Pa., has, I believe, been considered one of the richest localities in the world for fresh-water sponges. Perhaps the earliest mention of fresh-water sponges is that of Leonard Plukenet in 1696. These sponges, unlike those of commerce, possess a skeleton whose fibre is entirely composed of siliceous spicules, bound together by a very

small amount of sarcode, so that the least pressure will reduce a dry, fresh-water sponge to powder.

The study of the vital parts is attended with so much difficulty that it is only of late years that, with good instruments, a proper understanding of the subject has been attained. But the spicules upon which the classification is largely based are easily observed, and aside from their scientific value, make beautiful objects for the microscope. The spicules of the skeletons of the different species are all very similar, being simple needles of silica, sometimes slightly curved, more or less pointed, with the shaft either smooth or covered with spines. It is in statoblasts that we find the greatest variety of spicules. In general, the statoblasts may be said to be about the size of a mustard seed, varying in size or shape, but always approaching a globular form. On one side is an opening connecting with the soft matter of the interior. This soft matter is made up of a number of transparent sacs containing the germinal matter. The sacs are enclosed in a delicate membrane, which is again covered by a thicker chitinous coat. Outside of this is the wall or crust of the statoblast. This crust is composed of air-cells, in some species readily distinguished, whilst in others the highest powers of the microscope are required to resolve them. This structure causes the statoblasts to float when detached from the sponge, and probably in some cases serves to scatter the species. Again, the wall is accompanied by or charged with siliceous spicules of various forms.

The statoblasts are usually to be found at the base of the sponge, frequently attached to the object upon which it is growing, but sometimes scattered through the skeleton. In addition to the spicules of the skeleton and statoblasts, there is another kind, known as "dermal" spicules. These are generally more delicate than the skeleton spicules. Carter published his classification in 1881, based on the form of the statoblast spicules. These characters are very constant; and as all the fresh-water sponges probably, and none of the marine, come under the group *Spongillina* (that is, bearing reproductive organs called statoblasts), this classification, or some variation of it, seems an especially good one. Young sponges may be found as early as June, but mature specimens need only be sought late in the summer or in autumn. They are readily detected by their bristly surface. The colour and shape are generally more or less influenced by the position in which they grow. They may be found at the margins of rivers and lakes, and sometimes in deeper water. They are not unfrequently brought to the surface by dredging. The collections may be preserved in alcohol or by drying. But as the species can only be determined by examination with the microscope, it is

very desirable to have them prepared for observation. Before mounting, render them transparent by soaking the part to be mounted for several hours in glacial carbolic acid, made fluid by slight heat. When sufficiently clear, the specimen may be mounted in Canada Balsam without previously drying, as the acid and balsam mix readily. Skilful operators can prepare very interesting sections of the statoblasts, or the spicules may be entirely cleaned of all organic matter and mounted separately. Some use glycerine after they have been made perfectly transparent by the strong carbolic acid. I find a good way to liquefy the latter is to add a little alcohol, as much as will fill the space left at the mouth of the bottle (full); cork and invert, when the acid forces its way through and dissolves the crystals in a short time. The addition of the alcohol is no impediment except in cases where it is not required to use it.

Ants and Butterflies.

In the last number of the Journal of the Bombay Natural History Society, Mr. Lionel de Nicéville describes the manner in which the larvæ of a species of butterfly (*Tarucus theophrastus*, Fabricius) are cultivated and protected by the large common black ants of Indian gardens and houses. As a rule, ants are the most deadly and inveterate enemies of butterflies, and ruthlessly destroy and eat them whenever they get the chance, but in the present case the larvæ exude a sweet liquid of some sort, of which the ants are inordinately fond, and which they obtain by stroking the larvæ gently with their antennæ. Hence the great care which is taken of them. The larvæ feed on a small thorny bush of the jungle, the *ziziphus jujuba*, and at the foot of this the ants construct a temporary nest. About the middle of June, just before the rains set in, great activity is observable on the tree. The ants are busy all day running along the branches and leaves in search of the larvæ, and guiding and driving them down the stem of the tree towards the nest. Each prisoner is guarded until he is got safely into his place, when he falls off into a doze and undergoes his transformation into a pupa. If the loose earth at the foot of the tree is scraped away, hundreds of larvæ and pupæ in all stages of development, arranged in a broad, even band all round the trunk, will be seen. The ants object to uncovering them, and immediately set to work to put the earth back again; if this is taken away again, they will remove all the chrysalids and bury them lower down. When the butterfly is ready to emerge in about a week, it is tenderly assisted to disengage itself from its shell, and, should it be strong and healthy, is left undisturbed to spread its wings and fly away. For some time after they have gained strength, they remain hovering over their old home. In

one case a butterfly fell to the ground before its opening wings had dried, and a soldier-ant tried to rescue it. He carried it back to the tree with the utmost care, and made several attempts to assist the butterfly to hold on again, but finding his efforts unavailing he left the cripple to recover himself. On his return, seeing no improvement, he appeared to lose all patience, and, rushing in, bit off both wings and carried the body into the nest. But high-handed proceedings of this kind are very unusual. It is said to be a curious sight to watch the fragile and delicate butterflies wandering about, all feeble and helpless, among the busy crowd of coarse black ants, and rubbing shoulders in perfect safety with the ordinary fierce, big-headed soldiers. A larva of another species thrown down among them as an experiment was immediately set upon and torn to pieces by the ants.

Water-Gas.

Recently, under the auspices of the Society of Chemical Industry, Mr. Alfred Wilson lectured at the Mason College, Birmingham, on "Water-Gas for Heating and Illuminating." Mr. Wilson described generators for the manufacture of water-gas, such as are now in use in some European cities, principally in Germany and Austria, for the melting of steel, and also for illuminating purposes. The fuel employed for making this kind of gas is coke, of the kind which remains at gas-works after the illuminating gas of every-day use has been abstracted from the coal. The method of producing gas is as follows:—A cupola-shaped furnace is employed, in which the coke is raised to an incandescent heat by means of a blast of air. When it reaches that temperature, steam is passed through it and suffers disintegration, with the result that an inflammable mixture of hydrogen and carbonic-oxide is obtained. The mixture is then passed through a water-scrubber in the ordinary manner, and thence goes to the gas-holder. It is burnt as an illuminant with the aid of a new incandescent burner, known as the Fahnejelm, having a magnesia cone, and is so brilliant that a No. 3 Bray burner gives a light equal to that of twenty sperm candles of standard make. Its cost is understood to be about sixpence per 1,000 cubic feet.—*Photographic News.*

The Nearest Star.

The distances of the stars are ascertained in the same manner as those of the sun and planets—that is, by parallax. Instead, however, of taking two stations at the different parts of the earth's surface, and laying down a base line between them, we take the

diameter of the earth's orbit, or 183,000,000 miles, as the base, the observations being taken at intervals of six months. Even with this immense line, however, the parallax is so small that it can only be detected by the most careful observations and accurate instruments. The parallax of about a dozen stars has now been ascertained, and is found to vary between 0·919 second and 0·046 second. The star, *a* (Centauri), is the nearest to the earth, and its distance is estimated at 20,496,000,000 miles, while the average distance of stars of the first magnitude is probably three or four times as great as this.—*Scientific American.*

Everlasting Flowers.

The *immortelle* of the east (*Helichrysum Orientale*), a native of Asia, has been known in Europe since 1629, but was only first cultivated in gardens about 1815. Its flowers—the symbols of friendship, or tribute to talent and genius—serve to make the garlands of *immortelles* which ornament the tombs of the dead in Roman Catholic countries. It is cultivated in France in the communes of Lower Provence, where the soil slopes towards the Mediterranean. It succeeds very well on the slopes of Bandols and Clota, which are exposed to the south and enclosed by walls of stone. It blossoms about the month of June. It suffers from heavy and continuous rains and strong dews, and only vegetates well on light, stony, and permeable soils. It is propagated by offsets, which are separated from the old stocks. The gathering of the flowers is made in the first days of June, before the bursting of the buds. As the flowers which are insufficiently formed or too full blown are rejected by the trade, it is important not to cut them too soon or too late. The collection is made by women, who tie them in small bundles, which are ordinarily dried on the walls of the inclosure. Finally, young girls are employed to remove the down which covers the ramification. A kilogram (nearly 2¼ lbs.) of these plants contains about 400 stems, each containing about 20 flowers. Each growing tuft of *immortelles* produces 60 or 70 stems. A hectare (2½ acres) will contain 40,000 tufts, producing annually 2,400,000 stems, yielding 16,000 to 20,000 bundles, or 5½ to 6 tons of *immortelles.*

Torpid Liver.

One of the best and simplest remedies for a torpid liver or biliousness is a glass of hot water with the juice of half a lemon squeezed into it, but no sugar, night and morning. A person to whom this was recommended tried it, and found himself better almost immediately. His daily headache, which medicine had failed to cure, left him; his appetite improved, and he gained

several pounds within a few weeks. This is so simple a remedy that any person thus afflicted will do well to give it a trial, as it cannot possibly do any harm.

Sting of Queen and Worker Bees.

The sting of the Queen Bee is curved larger and slightly blunter than that of the Worker, which is quite straight and very sharp. The Queen's sting has three blunt barbs, and is about 1—200th of an inch in diameter; the worker's sting has from eight to ten sharp barbs, and is about 1—500th of an inch in diameter.

Answers to Queries.

335.—Double-Pointed Pins.—About the most likely place to get these in this country is from Eggleston, naturalist, Sunderland. If he has not got them in stock, probably he could get them.

J. A. Hogg.

340.— Blue Flame produced by Salt.—I have not been able to gather any definite information on this subject; but it appears to me that the yellow rays which are given off from the coal are absorbed by the sodium vapour through which they have to pass, as suggested by Mr. Searle. We know that rays given off by an incandescent element are absorbed by being passed through the same element in a state of vapour, forming, in the spectrum, absorption bands. Probably, this is what occurs here. J. A. Hogg.

341.—Hoar Frost.—In the powdery form of hoar frost the crystals are formed by the direct freezing of aqueous vapour. The larger crystals are produced by the freezing of thin layers of condensed moisture. J A. Hogg.

347.—Removing Shells from Brood.—So far as my experience goes, birds merely throw the shells over the side of their nests. It is nothing unusual to see a number of broken shells under a nest of newly-hatched birds. J. A. Hogg.

356.—Labelling Histo. and Patho. Cabinets.—Probably, the most convenient method would be to arrange the slides alphabetically from organs, as heart, liver, lungs, etc. J. A. Hogg.

377.—Plant-Crystals.—An interesting paper on this subject appeared in a recent number of the *Botanical Gazette* (May, page 139):—"The author, Dr. Schimper, divides the deposits into two classes, one of which is formed during the growing period of plants, and the other after the leaves have ceased growing, and the formation of the latter class seems to depend on the presence

of light, chlorophyll, and transpiration. He shows that the salt is capable of passing from one cell to another. It does not appear to be connected with the assimilation of carbon, but it would appear from experiments made that oxalate of calcium was indispensable for the transfer of starch. He further shows that the phosphate, sulphate, and nitrate of calcium which frequently occur in leaves, especially in the parenchyma of the veins where they are frequently deposited, are split up under the influence of light by the green cells, the nitrogen, sulphur, and phosphorus being used up in the manufacture of proteids. J. A. Hogg.

379.—Sections of Flower and Leaf-Buds.—The method described by Miss Latham on page 69 of the present volume gives very satisfactory results. J. A. Hogg.

391.—Mounting Parasites.—Objects should not be transferred directly from spirit to Canada balsam, but should be soaked in oil of cloves and then in turpentine. Spirit is not a complete solvent of the resin of Canada balsam. J. A. Hogg.

392.—Snow-Crystals.—Any means by which snow-crystals could be preserved in a room at ordinary temperature must of necessity be of a somewhat complicated nature. However, although it is difficult to bring in the snow, it is not so difficult to take out the friends and the microscope. J. A. Hogg.

400.—Abbe Condenser.—In my reply to the above in the *Scientific Enquirer* of October, there are a couple of printer's errors which ought to be corrected. In one case a semicolon is displaced. It ought to read:—"With a lens of 75°, like Zeiss D (⅛"), it will give it; with large angles, the oblique rays enter the objective." That is to say that the Abbé condenser will give dark-ground illumination up to 600 diameters with a low-angle lens like Zeiss ⅛" (75°), but with the ordinary high angles it will not.—— Secondly, the name "Leitz" is misprinted "Leith," an unknown maker. J. G. P. Vereker.

401.—Poison of Bees, Wasps, etc.—The poison of wasps, ants, etc., is generally supposed to be more or less concentrated formic acid; but recently a large number of animal alkaloids have been discovered whose existence was not before suspected. It is quite possible that something of the kind exists in wasps. J. A. Hogg.

413.—Opacity.—Possibly, a prolonged soaking in oil of cloves or turps would make them transparent. Why not use a solution for bleaching, liquor potassæ, or a bleaching liquid made by adding ten drops of strong hydrochloric acid to half a drachm of chlorate of potash, and adding, after fifteen minutes, one ounce of water? When clear wash, transfer to spirit, oil of cloves, turps, or balsam. J. A. Hogg.

414.—Forming Cells.—I have been waiting with great interest to see whether anyone would answer Z. S.'s question about making holes in glass for the purpose of forming cells, as I believe that cells thus formed are far and away the best that can be had at a cheap rate, *especially for sending by post.* It stands to reason that a square inch (or more) of glass can be cemented to a slide far more firmly than any mere ring. I have not had much experience, but I believe Z. S. will find the following plan answer until he can learn a better:—(1) Get the blacksmith to make you an iron plate, sufficiently thick to be perfectly rigid (something less than $\frac{1}{4}$ inch will do), and to drill a dozen or twenty holes in it (it is a great saving of time to be able to make a good many cells at once) of the size and shape you want your cells to be. (2) Take scratched, clouded, or rubbed slides, useless for any other purpose, and cut them into pieces an inch square, or, if you want long oblong cells, $1\frac{1}{2}$ by 1 inch. (3) Then heat your glue-pot. Common glue does very well, but I use best glue with a little sugar in it, and glue your pieces of glass over the holes, taking care to leave the opposite margins equal. Use the glue thin and hot, and *warm*, but do not *heat*, the iron plate before you affix the pieces of glass. (4) Leave the plate for a couple of days, so that the glue may get perfectly hard and dry. (5) Then, placing your iron plate with the glass pieces uppermost on a folded newspaper, take a stout file out of its handle; see that the point that has been in the handle is sharp. Place the point on the centre of the cell to be formed, hold it perpendicularly, and strike the other end of the file a sharp tap with a mallet. The glass will splinter as far as the margin of the hole in the iron, and, if you are lucky, no farther. A few more light taps on the splintered glass will enable you to introduce a circular or semi-circular file, with which you can file away the glass that remains, till it is flush with the sides of the hole in the iron plate. (6) Put your plate into a basin and pour boiling water on it. In a minute or two you can *push* off the cells that you have made. I fasten them on to slides with marine glue, but I fancy common glue would do just as well.

It must be allowed that the edges of the cells are not very smooth—at least, I have not succeeded in making them so; but a black band of asphalt, when you have mounted your object, will conceal this, and give them a very neat appearance. When the glue has once set, they can be made very quickly. I have made sixteen (and marred two) in about half-an-hour. If anyone can suggest improvements on this plan, I should be very glad to know them, for (as I said) I have only tried to make them quite recently.

"Si quid novisti rectius istis,
Candidus imperti; si non, his utere mecum."

OREB.

414.—Forming Cells.—Holes may be drilled through thick glass by means of a hard-pointed drill moistened with turpentine. The method recommended by Beale is good. A piece of thin glass is cemented to a ring or circle (used for making deep cells) with marine glue. When cold, a file is pushed through the centre. The cracks do not extend through the marine glue. The edges are filed square, and then the thin glass is warmed and removed. It may be cleaned by means of potash.

J. A. Hogg.

415.—Drawing Micro Objects.—*Vide* answers to 379 in the October *Scientific Enquirer*. It is hard to say which is the *best* instrument for drawing microscopic objects, but there is no doubt about the cheapest, and that is Beale's form, as it can be easily made at home as follows :—If the eye-piece has a cap, remove it and make a cardboard tube to fit over it, in place of the cap; if the ocular is of the foreign form, a cardboard or paper tube must be made to fit over the body of the microscope, so as to bring it flush with the rim of the eyepiece, and a cardboard tube made to fit over the body. Cut one end of the tube at an angle of 45° with its axis, like an ordinary mitre joint, and fix on this another flat piece of card, with a hole in the centre. Over this hole fix a thin cover-glass, and above this cover-glass cut a fair-sized hole in the cardboard tube. Make the tube of such a length, that when pushed home the edge of the cover-glass will about touch the eyepiece. Blacken the inside with ink or paint (a couple of visiting cards and some gummed paper will do all this work). The objection to this form is that it reverses the objects. Another way of drawing is by means of a piece of glass ruled in squares, known as a net-micrometer, which is placed on the top in the eyepiece. The drawing is done by hand on a piece of paper ruled in squares. Very good work can be done by this method, and the instrument also forms a very convenient eye-piece micrometer. These net-micrometers cost from 4/- J. G. P. Vereker.

415.—Drawing Micro Objects.—I have always used Beale's neutral-tint glass, and find it a very useful little instrument. The main difficulty is with the light, and it is only by practice that one is able to get the proper illumination. The object appears to be thrown on the paper, and the size of the sketch may be varied by bringing the paper nearer to or further from the eyepiece. The paper is usually placed at ten inches distance. A simple substitute, invented by an American, Mr. Jennings, may be interesting. Take a flat cork, 1¼ inches in diameter, through which cut a hole so large as to fit on the eyepiece without the cap. Then make a transverse slit beneath the hole, in which place a glass cover inclined at an angle of 45°. J. A. Hogg.

416.—Transferring Pictures.—This process consists in causing the ink of a print, engraving, etc., to adhere to wood by cementing the face of the print to its surface, and then destroying the texture of the paper, so as to leave the ink upon the varnish and material operated upon. Required—(1) Transfer varnish; spirits of wine, 5 oz.; Venice turpentine, 4 oz.; picked mastic, 1 oz. Place in a wide-mouthed bottle, and shake frequently till dissolved.

(2) Smooth wood, pumiced and sand-papered. First, put a coat of transfer varnish on the wood and leave for twenty-four hours (this prevents the wood being soiled). Cut off white margin of print, and place face upwards on water till well soaked, keeping the printed side dry. When soaked, spread a coat of varnish over the face, and apply immediately to the wood. Rub down with a towel. Then with a finger rub off half the thickness of the paper and let it dry. Then wet the finger only, and rub till only a white film of paper remains. Let it dry and clear with a little oil of almonds. Then apply carriage varnish. J. A. Hogg.

419.—Mounting in Balsam.—It is not desirable to exert too much pressure on objects mounted in balsam and benzole. If the natural oleoresin be used, the slide should be sufficiently heated to drive off the volatile oil. The balsam will then set, so that the slide may be finished off in a few hours. J. A. Hogg.

420.—Dendritic Spots.—These are best seen as transparent objects. I have one which I found on thin white paper. This was soaked in oil of cloves till quite transparent and mounted in balsam. If on thick blue paper, better mount as an opaque object. J. A. Hogg.

421.—Coccoliths.—These, like other chalk-organisms, are best seen when dried and mounted in Canada balsam. J. A. Hogg.

422.—Chalk-Organisms.—In examining masses of organisms whose particles are but loosely united together, it is desirable to separate as much as possible the entire forms from the broken residue. Brush a piece of chalk under water with a soft brush. The powder will diffuse through the water, and some of it quickly subsides. The first deposit generally contains the larger Foraminifera, together with broken shell, etc. The smaller forms come down afterwards, leaving the amorphous powder in the water, which should be then poured away. The powder may be then dried and mounted in Canada balsam. J. A. Hogg.

424.—Book on Minerals.—I presume Mr. Steel wants a work on Mineralogy so as to be able to recognise minerals when he sees them. Professor Dana has published a large work on the subject, which is, I believe, considered one of the standard works, but it is

expensive. There is a smaller work by him called "A Manual of Mineralogy," which perhaps would suit Mr. Steel. The price is, I think, 6/-, published by Trübner and Co., 57 Ludgate Hill, London. Mr. Rutley has also written a very convenient work, price 1/6, published by J. Murby, 32 Bouverie St., Fleet St., London. If Mr. Steel wants a book on the analyses of minerals by the blow-pipe, there are several works sold by Messrs. Griffin and Co., chemical manufacturers, Long Acre, London. The fullest is, perhaps, Ross's "Pyrology," but Landauer on the "Blowpipe" is a very good work. J. G. P. VEREKER.

424.—Book on Minerals.—A good book, arranged according to the system used at the Museum of Practical Geology in Jermyn Street, is Collins' "Mineralogy," published by Collins, Sons, and Co., at 2/6. J. A. HOGG.

426.—Decolourising and Staining Leaves.—The bleaching is best done with a solution of hypochlorite of soda (the *Liq. Sodæ chlorinata* of the chemist). Sections bleach in a few hours, leaves in a few days. After bleaching, wash thoroughly in running water for some hours. Then doubly stain with logwood and aniline blue or other dyes. J. A. HOGG.

427.—Aquarium.—A good handbook on the subject is the Rev. J. G. Wood's "Fresh- and Salt- Water Aquarium," published by Routledge, price 1/- J. A. HOGG.

428.—Mounting Crystals.—Castor oil is certainly the best medium for mounting crystals. I have mounted many slides in this manner, and find that a good thick coat of gold-size makes a very satisfactory and lasting preparation. There is an interesting chapter on "Micro-Crystallisation" in Carpenter on "The Microscope." J. A. HOGG.

429.—Stinging-Hairs.—I have found prolonged soaking in dilute glycerine, and finally mounting in glycerine jelly, to give good results. Once, with a very dry nettle-leaf, I got a good slide by soaking in turpentine and mounting in balsam, but this was the exception. J. A. HOGG.

430.—Portland Cement.—I am sorry I cannot give the details of this process. The main point, however, is the heating of an impure lime containing clay and silica. This, on moistening, forms a double silicate of calcium and aluminium, which becomes hard and is not affected by water. J. A. HOGG.

431.—Foraminifera.—The following operations from a paper by Mr. Elcock, in No. 1 of *The Journal of Microscopy*, may be what "C." requires:—

1—Wash well to remove salt; 2—Dry perfectly, allow to cool; 3—Sift (sieves Nos. 50 to 60); 4—Float fine material in cold

water; 5—Dry; 6—If necessary, boil with caustic potash; 7—Wash out all potash; 8—Dry; 9—Re-float in a beaker; 10—Dry and mount. Always mount Foraminifera dry and view as opaque object. J. A. Hogg.

433.—Red Snow.—The red snow plant (*Protococcus* [*Palmella*] *Nivalis*) sometimes tints large tracts of snow in Arctic and Alpine regions. The colour extends for many feet downwards. Formerly, the plant was considered to be a *Protococcus* (in which the cells have little or no attraction for one another). But it has now been proved that its cells are connected by a gelatinous investment, which places it under the *Palmellæ*. Hence the corrected name. J. A. Hogg.

435.—Glycerine Mounts.—Sooner or later, glycerine is sure to find its way through the cement. The best thing you can do is to wipe off any glycerine which has escaped, and put on a thick coat of gold-size. Glycerine mounts should have a ring of new cement every year. J. A. Hogg.

438 —Sections of Teeth.—For examination of teeth with bioplasm, etc., the following may be of use:—Break up a freshly-extracted tooth with a hammer, and transfer pieces to Beale's carmine fluid. Leave it so in a warm room for one or two days. Then pour off the carmine and add dilute glycerine. After a few hours pour off the dilute glycerine, and add strong glycerine with acetic acid (5 drops to 1 oz.). If it is desired to study the nerve arrangement, a few drops of chromic acid solution must be added. The tooth may be removed in four days to glycerine and acetic acid. A number of sections are cut from the broken surface with a strong knife and examined in glycerine. If desired, finally mount the sections in acid and glycerine. J. A. Hogg.

441.—Fresh-water Sponges.—Sponges should be drained and quickly dried without pressure. Thin sections should be made both along and at right angles to the surface. These should be placed in water on the slide, the water drained off, and the sponge allowed to dry. They should then be mounted in balsam and benzole, taking great care to remove all air-bubbles. The spicules of sponge are best obtained by boiling the sponge with nitric acid until the organic matter breaks up. The flinty deposit is then washed by adding water, allowing the spicules to subside and pouring off. This is repeated till all acid is removed, and the spicules are then mounted in balsam. J. A. Hogg.

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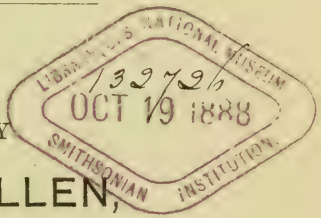

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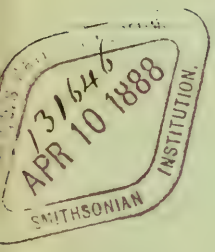

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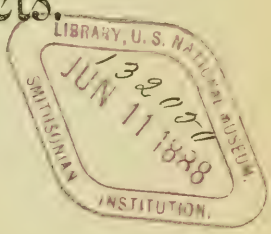

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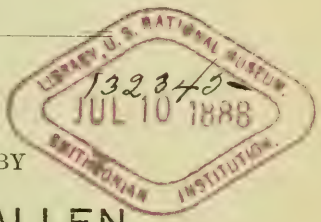

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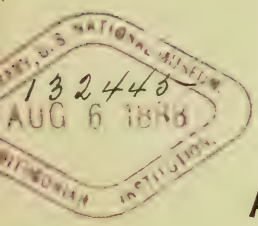

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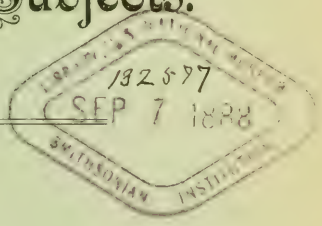

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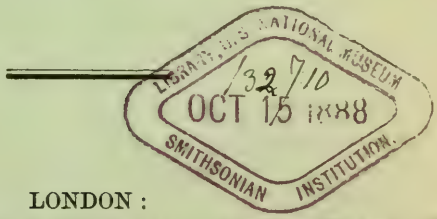

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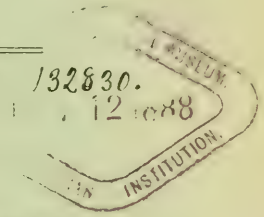

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